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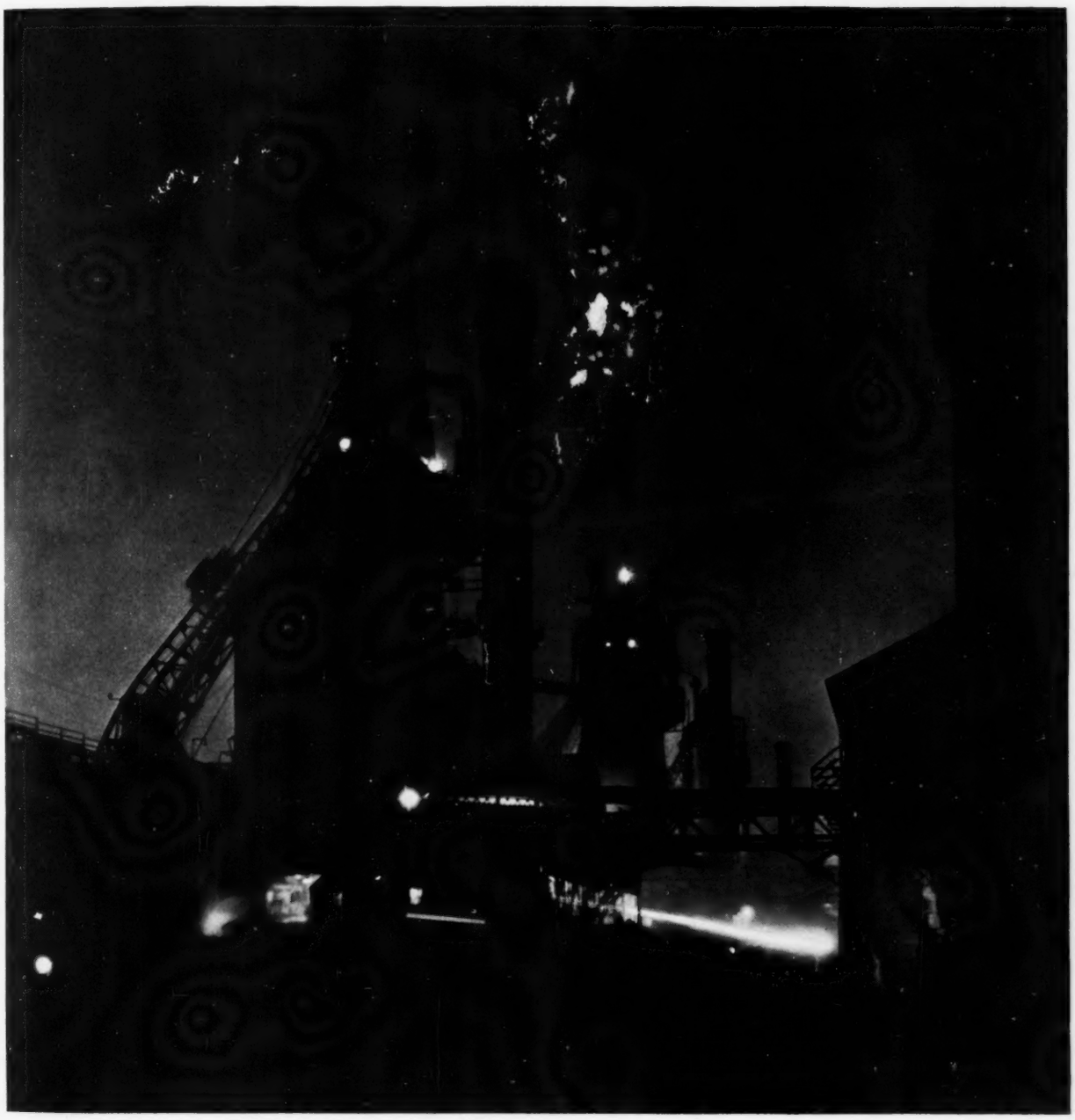
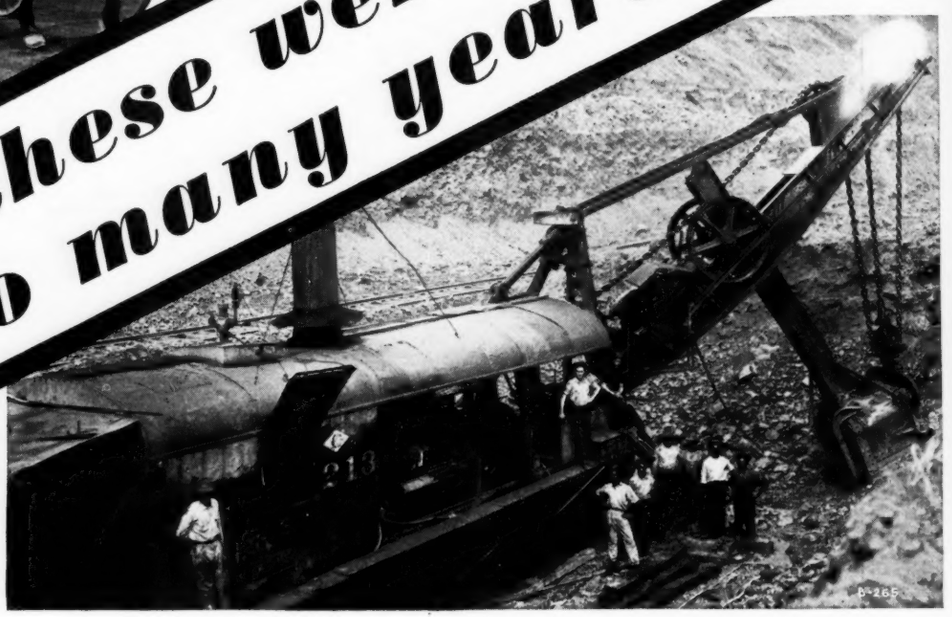


Night brings no stop to mining and metallurgical enterprise

December 14, 1931

To the owner of that good old railroad shovel

Both these were modern not so many years ago!



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Merry Christmas, folks

AS OLD 1931 starts gasping for breath, presaging the end, we glance backward momentarily and find that we have done not so badly during the year, as things go nowadays. We believe it is because we have worked hard and always tried to be cheerful and optimistic in spite of the encompassing hordes of woe-mongers and crepe-hangers. And we're going to try a lot more of the same in 1932 because America is very much all right, and we are of America!

ANOTHER thing,—we have become set in our habits and two of them are having a Merry Christmas and a Happy and Prosperous New Year. We firmly believe Time owes us these two things every year, and there don't exist any conditions or circumstances that are strong enough to keep us from getting 'em! And how about YOU, our friends and customers—won't you join us? We'd sure like to have you, and you CAN if you WILL! And maybe, between us, we can show the world how silly it is to fuss and worry!

CHEERIO!

Traylor Engineering & Manufacturing Co.

Allentown, Pennsylvania, U. S. A.

Engineering and Mining Journal

McGraw-Hill Publishing Company, Inc.

December 14, 1931. A. W. ALLEN, *Editor* Vol. 132— No. 11

All Should Share the Unemployment Burden

FEW who are associated with the profession and industry of mining engineering are untouched by the current dullness in almost every line of industrial activity. Even those with unreduced salary, and whose loss of income from investments is offset, somewhat, by a lower cost of living, have been called upon to make material contributions to alleviate the condition of those in dire distress. Efforts to raise funds for this purpose have met with splendid success in almost every community. Usually the quota is oversubscribed.

Most of these campaigns have been community enterprises, with an appeal to the entire citizenry for the benefit of the destitute. It is regrettable that some of the most deserving cases go undiscovered. Pride keeps many a family from applying for relief, or even from letting any one know of a dire need. Professional men, especially, will do almost anything rather than allow themselves to become recipients of what they consider charity.

The mining fraternity is perhaps more fortunate in the current emergency than are some of our professional brothers in other branches of engineering. In the New York area, for example, over a quarter of the civil engineers are unemployed, but only about three per cent of the resident mining engineers. One reason for this is that most of the many mining engineers in this area have attained the higher positions and would be retained in the dullest times. In the field, the proportion of mining engineers out of work is certainly much larger, and in some districts conditions are such that aid is urgently needed by a considerable number of technically trained men.

In New York, a Professional Engineers' Committee on Unemployment is actively at work. This is a project of the New York sections of the four engineering societies—civil, mechanical, electrical, and mining. It is proposed to solicit contributions of 2 per cent of the earnings of those who are employed, for the next five months. From those who can afford to give more, a larger flat contribution is to be asked. A fund of from one hundred to two hundred thousand dollars should thus be raised, to be expended in three general directions: for the promotion of new engineering work and the provision of new jobs, for short-term loans to those who require help, and as outright gifts in dire cases of distress.

Many engineering organizations in other parts of the country have also taken similar steps to help their unemployed professional brothers. Every group of mining engineers that meets this winter should give attention to this humanitarian problem at its first opportunity. A professional man should be made to feel that his associates, through some central delegated authority, will help him, and spare him the necessity of appeal to the general community chest.

Flotation Extends Into New Fields

BENEFITS invariably accrue from an interchange of methods and equipment among the various branches of the mining industry. The alert engineer is always on the lookout for new ideas, which may come from the most unexpected sources. Grinding, settling, and filtration technique developed primarily for the treatment of metallic minerals has found successful application in the non-metallic field. Dust precipitation by electrical discharge is also being adopted by producers of non-metallic minerals.

Of particular significance has been the tremendous increase in the adoption of a technique developed in the handling of finely divided material in a water medium, in connection with the treatment by hydrometallurgical methods of precious-metal ores. Sizing and classification practices have been carried to so successful a degree in the recovery of metals that the procedure and equipment have suggested means whereby an effective separation may be made of one non-metallic mineral from another.

Indications are accumulating that flotation, essentially a metallurgical development, is extending its influence into many branches of the non-metallic field. A survey of present European flotation practice reveals that remarkable progress has been made in this direction. Graphite, phosphate, fluorspar, cryolite, barite, talc, mica, kaolin, sulphur, and magnesite are among the products now treated successfully on a commercial scale. A list of the reagents used in these operations includes names familiar to flotation operators, such as pine oil, creosotes, petroleum products, oleates, sodium carbonate, and sodium silicate. Another notable development is the rapid advance of flotation methods for cleaning coal.

In an age of specialists, the value of a broad fundamental knowledge is frequently overlooked. He who keeps informed, even superficially, with trends and developments in allied fields, is bound to reap many benefits. The old proverb that the one-eyed man rules supreme in the realm of the blind offers food for thought to those who advocate a policy of specialization that leaves no room for the fruitful interchange of knowledge and experience.

The Presidency of the Institute

THE citation accompanying the bestowal on Mr. Scott Turner of the honorary degree of Doctor of Engineering by the University of Michigan, in 1930, read as follows: "Mining engineer, and Director of the United States Bureau of Mines; a commendable scion of Michigan pioneer stock and a graduate of its university; distinguished for his achievements in the development of engineering projects of enduring import in many, even remote, portions of the world, from South American to Spitzbergen; generous in public service, and a valued representative of the United States to world congresses in his special fields; author of many technical and scientific articles, and an ardent worker for the conservation and wise utilization of natural resources." This is a thumbnail sketch of a distinguished member of the profession who is destined to be the president of the A.I.M.E. for the coming year.

Among those who have urged the creation of an economic division of the Institute, none has been more prominent than Doctor Turner. Studies of the economic problems of the mining industries have hitherto been undertaken by the Mining and Metallurgical Society of America. Doctor Turner favors close cooperation between the Institute and that society, if absorption of the latter by the former be not practicable. He also favors a resumption of relationship with American Engineering Council—the more desirable if the Institute undertakes economic studies—to provide a channel through which to convey its conclusions and recommendations to Congress. Doctor Turner, as is well known, believes that the Institute should make its influence felt at Washington to a greater degree than it has in the past.

Engineering and Mining Journal assumes that Doctor Turner's election to the presidency of the Institute will represent an almost unanimous vote. No predecessor in that important post was better qualified than is the present candidate to direct the affairs of one of the most influential engineering societies in the world, in a period when a knowledge of international as well as national affairs is essential to the solution of industrial and professional problems.

The United States Still Has Its Craftsmen

SHIPMENT abroad of raw material for processing, and the subsequent importation of the finished product, would seem particularly undesirable when many domestic industries are operating at a rate much below normal and unemployment is widespread. The contention may be held that certain specialized operations necessitate the employment of skilled craftsmen in foreign countries. A little thought and investigation, however, discloses no valid exception to the belief that such work can be done equally well in the United States. And, if a "manufactured in 'this or that' country" stamp on the finished product makes an article more desirable to the prospective purchaser than would an almost identical product of domestic manufacture, American merchandising methods need revision; or, perhaps, the country needs advice comparable to that which British industry receives from the Prince of Wales when he urges the peoples of the Empire to purchase British-made goods.

A case in point has its origin and conclusion at Rapid City, South Dakota. Several weeks ago Miss Mary Garden, the opera singer and impresario, gave a concert there, following which an appreciative committee presented her with a gold nugget and a necklace of rose quartz beads. The nugget, of course, came from nature's workshop. The necklace, however, according to information forwarded by a correspondent, was made of raw material obtained from a mine near Rapid City, forwarded to Germany for manufacture into beads, and then returned to South Dakota in the form presented to Miss Garden. Whether or not the fact that the beads were fashioned in Germany was disclosed at the time of the presentation of the necklace is not known, but a guess is hazarded that the sentimental appraisal—more important in such instances than intrinsic value—of the gift by its recipient would have been enhanced if the necklace had been the work of American craftsmen. Surely, the services of lapidaries with sufficient ability to make such a necklace of quartz beads at a reasonable cost are available in the United States. Certainly they should receive the support and encouragement of the domestic jewelry trade, and also of the industry that supplies the raw materials.

Loss of Morale Must Be Avoided

IDLENESS, enforced idleness, has a more subtle effect than to thin the pocket book. One gradually loses confidence; the stiff upper lip begins to droop a little; morale is affected. The story is told of a respectable-looking person who had collapsed from hunger and who was asked: "Surely you could ask for a few pennies from passers-by; enough to buy bread." "Ah," he replied, "but that takes nerve."

The professional engineer out of a job should, of course, devote much of his time to finding something productive of income. But he should not neglect opportunity to make his services more valuable when the desired job is attained. He might master a foreign language; or he might devote a few hours a day to studying the fundamentals, or certain neglected phases, of his professional work. Is he fully abreast of the times in respect to the theories being taught in the engineering colleges today? Assistance in this direction can be given by the schools, and practical help has already been offered by Columbia University. A special course of lectures and classes, arranged by Dean Barker of the Engineering School, will be open to accredited members of the profession who are idle through no fault of their own. No fees will be charged, of course, and no credit towards a degree will be given. Other engineering schools might well follow this example, and thus afford valuable assistance in preserving that all-important factor among professional men—satisfactory morale.

Even the idle miner or mill man should, whenever and

wherever the practice may be followed without diminishing an already depleted sustenance fund, be encouraged to devote time to the study of the technical advances made in mining and milling, and to the reading of general literature and current newspapers and magazines, free or used copies of which are usually available in all communities. Furthermore, and most important, all now unemployed should take as much exercise in the open as is physically possible—in walking, hunting, fishing, chopping wood, or gardening. To a man or a woman accustomed and inured to routine activities occupying at least half the waking hours of the daily span, idleness is deadly. Any activity, even though it be unremunerative, should be practiced, even at cost of personal convenience, or circumstance, or inclination.

Gold Production
Reaching New Peaks

SINCE Great Britain went off the gold standard, on Sept. 21, attention has been focussed on the metal by which a large part of the world measures its wealth. Gold may not be wealth itself, as King Midas discovered, but it has proved an excellent yardstick with which to measure wealth. When nations are forced, temporarily, to abandon the official use of that yardstick, doubt as to its value naturally arises. Some people are wondering if gold really is necessary to world finance, if it is not outmoded. Others think that not only is gold necessary, but silver as well. This publication makes no pretension to omniscience in its knowledge of the devious workings of international commerce and finance. It does realize, however, that an important corollary to all discussions of the validity of the gold standard is a knowledge of gold production and of its probable future trends.

Despite the statistical evidence that 1930 offered to disprove the oft-repeated contention that gold production is waning, the claim still finds expression, particularly in banking circles. The current year should afford even more conclusive proof that gold production is now increasing at a steady gait. In a recent issue of this publication, an estimate was made that gold production in 1931 would be twenty-one million ounces, or about four per cent higher than the 1930 output. Monthly returns from important gold-producing centers confirm these estimates.

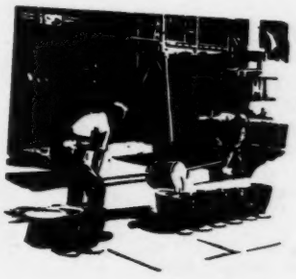
In October, the Transvaal set a new record for monthly output by producing £4,016,730 in gold on the basis of the South African pound, which is still on the gold standard at 84s. an ounce. This is the first time in the forty-odd years through which its gold-mining history runs that the Transvaal has produced more than £4,000,000 in one month. The first ten months of 1931 show an increase of £500,000 over the corresponding period of 1930, and 1930 was a record year. The total output of the Transvaal from 1884 to date is now more than £1,100,000,000 in gold—a sum even larger than the total gold holdings of the United States, which has a greater gold reserve than any other nation.

The increase in Transvaal production is based on the prosperity of its individual mines. One reads with interest, therefore, that many of the mines earned in October the highest profits they have ever recorded. No greater incentive to develop additional stretches of Witwatersrand ground could be afforded investment houses than this concrete proof of the profits to be made on the Rand. East Geduld, the newest addition to the list of Rand producers, also reported that October was the first month in which income exceeded outgo. This in spite of the fact that production started only in July and that capacity has not yet been reached. May the Rand have many such Octobers!

And Competent
Engineers Are Idle

FROM the Northwest comes a weird and wonderful report on a mining property, compiled by a self-styled mining geologist. The rock formations are described as "a thick series of sedimentars invaded by masses of perphry quarts, mongomite . . . and limestone. Black slate occurs in places, highly silicious, classed among the family of melmorphic and sedimentary eruptive rocks that constitute the Saw-Tooth Range of Mountains." The report concludes as follows: "The economic question is asked by the capitalist—will the mining property justify the expense of equipping it with modern mining, milling and transportation machinery. This queston I not youe were careful so far as the physcal possibilities of the property are concerned by employing a competent staff of competent engineers and when an engineer is sent out to make a report, it is because he is competent to judge and you want his judgment as to the possibilities of making a profit. Mining today is an industry, an engineering job, requring equipment and skilled labor and is not a fortune seeking gamble. . . . I use no hesitancy in recommending this property for a safe and sound investment, under judicious management. With all its present values in sight and its greater values are yet to come from the depths untouched, this mining property will pay you handsome dividends for years to come."

The results of such excursions beyond the intellectual capacities of psuedo-geologists may stimulate a laugh from the experienced engineer, but several serious aspects of the matter deserve attention. Such an estimate of a natural deposit is as likely to miss favorable indications and to ignore favorable factors as it is sure to make ignorance a basis for optimistic forecast. Reports of this character—and their number appears to increase—are a hindrance to legitimate mining advance. They indicate the miscarriage of fees for professional service, and absence of provision to protect the public or to consolidate the profession of mining engineering.



Automatic Pulp Sampling And Distribution

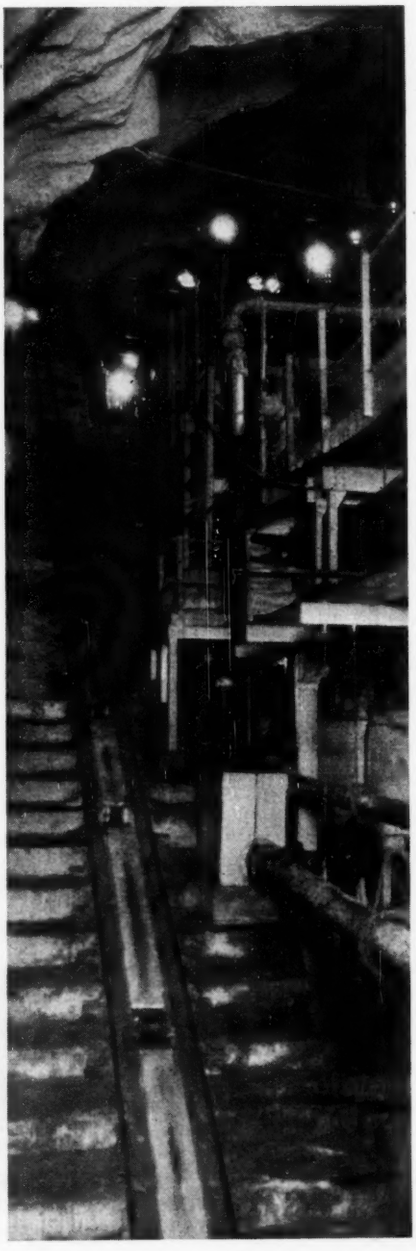
I. S. Heller

TWO types of samplers, continuous and time, are used in the underground mill of The Empire Zinc Company, at Gilman, Colo. The continuous sampler was developed[1] at Austinville, Va., by The Bertha Mineral Company, another subsidiary of The New Jersey Zinc Company. It consists of a sample cutter 15 in. long, formed by two radial plates, which are welded to an inclined slotted steel pipe. As shown in Figs. 1 and 2, this pipe forms the bottom of the cutter, and discharges into a hollow, vertical shaft, with which it rotates. Both shaft and sample cutter are mounted within a cylindrical steel tank, 4 ft. in diameter, which receives the reject. The sample cutter, driven by a ¼-hp. motor through a worm-gear reducer, rotates continuously at constant speed in a horizontal plane and passes under the pulp stream to be sampled. This stream is delivered by a vertical pipe, the discharge of which is 15 in. from the center line of the vertical shaft and directly above the middle point in the path of the sample cutter. A definite portion of the entire pulp stream is cut and passes down the inclined pipe to the hollow shaft, and thence through the hollow shaft to the sample container. The reject passes into the steel tank, where it is collected and piped to the next operation.

The quantity of sample cut depends upon the proportion of the width of the sample cutter to the distance traveled. In these samplers the average diameter is 30 in. and the average circumference 94.25 in. Therefore, with a cutter ⅛ in. wide, the ratio of the sample to the stream is 1 to 1,508, which is about the maximum ratio for this size of continuous sampler. Provided sufficient care is taken in determining the ratio and in keeping the edge of the cutters clean and free of wood pulp and other fiber, the samples, when weighed and multiplied by the ratio, will check closely the monthly shipping weights of the finished products. The daily production rate, in tons per hour, is obtained readily by weighing the samples.

When the underground mill was designed, a decision was made to sample automatically all the feeds and products of the various departments, except the jig and table lead concentrates, which, being small in quantity and easily dewatered, could be collected in bins for weighing and sampling on each shift. This required the automatic sampling of the following products: crude ore, primary colloids, feed to tables, table tailing, lead feed colloids, feed to lead flotation cells, flotation lead concentrate, zinc feed colloids, feed to zinc flotation cells, flotation zinc concentrate, and zinc flotation tailing.

Part of the flotation plant along the service incline. Sampler tanks are seen at the right.



To keep the weight of the samples within a reasonable amount, a sampler with a ratio of 1 to 25,000 was required. A continuous sampler of this ratio, however, would have to be about 50 ft. in diameter. Therefore, development of a time sampler of the following specifications was necessary: ratio about 1 to 25,000; speed of the sample bucket constant when taking the sample, and not over 3 ft. per second; samples to be taken every two minutes. After trying various mechanical methods, a combined mechanical and electrical method, shown in the accompanying illustrations, was developed.

The sampler proper is the same as the continuous sampler shown in Fig. 1, but with starting and stopping mechanism mounted above the drive, as shown in Fig. 3. Control of the acceleration and deceleration periods, to assure a uniform speed of the sample bucket when taking the sample, is effected through an adjustable track. The timing mechanism that operates all the time samplers is in the central part of the mill. Fig. 4 shows the wiring diagram of the mechanism and the time sampling system. The common timer shaft turns at the rate of 30 revolutions per hour. Each sampler has an individual cam on the shaft, as well as a separate rocker arm and mercury switch.

Referring to Figs. 3 and 4, operation of the arrangement may be explained as follows: Rotating cam *A* on the common timer shaft tilts the rocker arm that holds mercury switch *B*, which then closes and energizes solenoid *C*. Solenoid *C* lifts the roller out of the slot in the table attached to the shaft of the sampler and, at the same time, tilts the rocker arm that holds mercury switch *D*. This movement closes the switch and starts the motor that operates the sampler. As soon as movement of the table begins timing cam *A*, by its rotation, permits switch *B* to open. This de-energizes solenoid *C*, and the idler drops onto the circular track carried by the table. The sampler and table then move through a complete revolution.

[1] "Handbook of Milling Details," p. 15; McGraw-Hill Book Company.

This is one of a series of articles describing the operations of The Empire Zinc Company at Gilman, Colo.

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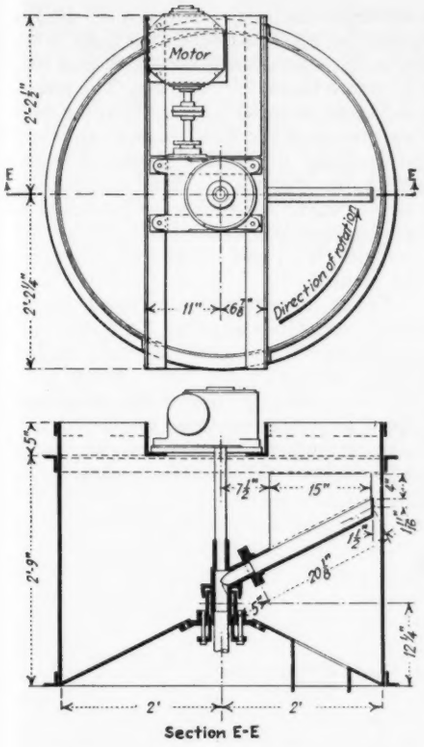


Fig. 1—Assembly of continuous sampler

They stop when the slot in the circular track appears under the roller, because, when the roller enters the slot again, the solenoid plunger drops and opens switch *D*.

A sample cutter travels at the rate of eight revolutions per minute and makes one cut every two minutes. Therefore, the distance traveled, if run continuously in one sample cycle, is 94.25x8x2 = 1,508 in. And 1,508 in. divided by $\frac{1}{16}$ in. is 24,125, or the sampling ratio for a cutter with a $\frac{1}{16}$-in. width is 1 to 24,125. Nine time samplers are used in the mill, all of which are equipped with sample cutters that have openings $\frac{1}{16}$ in. wide. Three continuous samplers are employed. These have cutters with openings of $\frac{1}{16}$ in., $\frac{1}{8}$ in., and $\frac{1}{16}$ in. wide, respectively.

The crude ore is first sampled after leaving the Herman mill, in which it is crushed to pass through a screen with a $\frac{1}{16}$-in. opening. Sampling ratio is about 1 to 100. The sample, which totals 6 to 7 tons per day, is crushed in a 2x4-ft. Marcy rod mill and resampled with a continuous sampler that has a cutter with a $\frac{1}{8}$-in. opening. Sampling ratio is 1 to 754 in this instance, yielding a sample of about 5 to 6 lb. per shift. Flotation lead concentrate is sampled with a continuous sampler of 1 to 1,508 ratio. Table lead concentrate is collected in three drainage bins, one for each shift, and is weighed separately and hand-sampled, so that the quantity and grade for each shift are obtained. Jig lead concentrate is treated similarly.

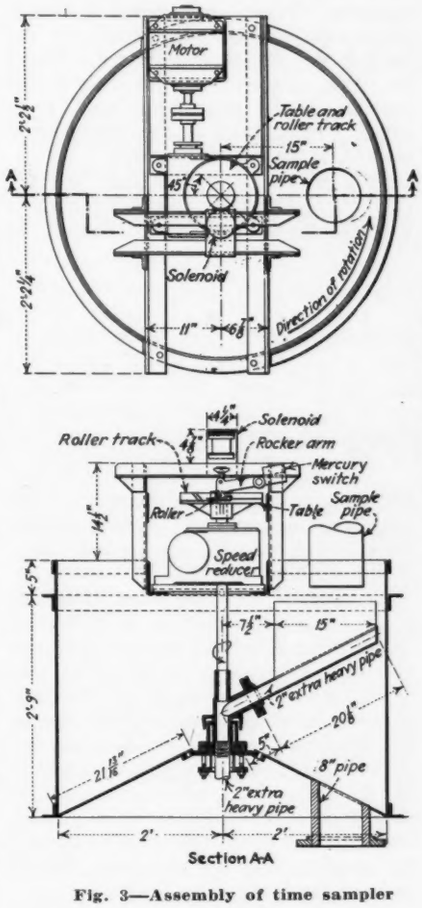


Fig. 3—Assembly of time sampler

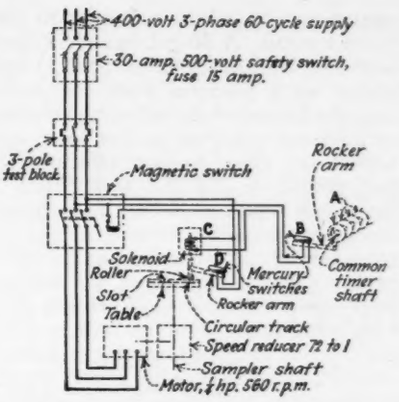
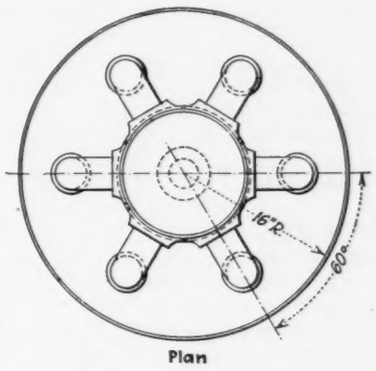


Fig. 4—Wiring diagram of timing arrangement



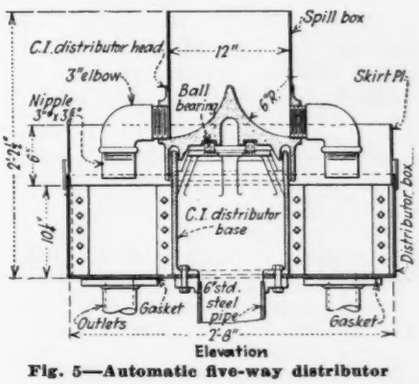


Fig. 5—Automatic five-way distributor

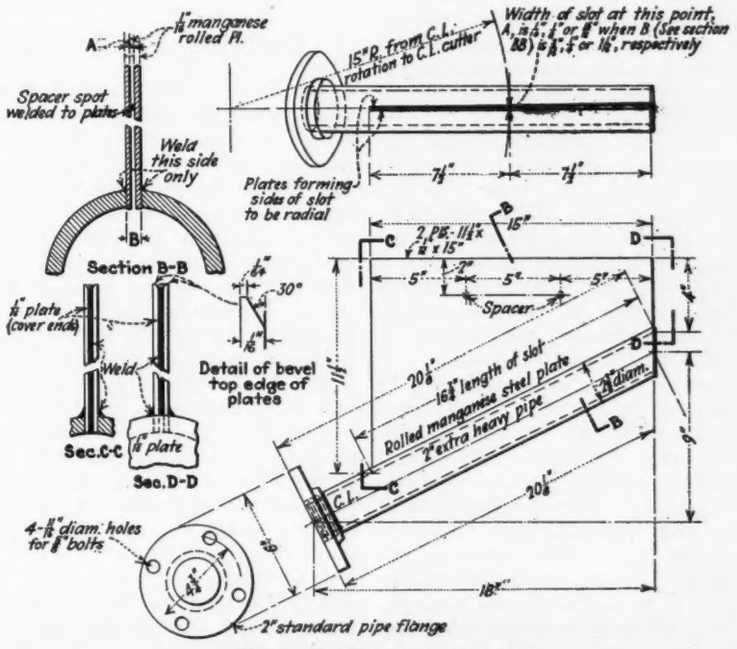


Fig. 2—Details of sample cutter

Sampling ratios, so far as the design and construction of the samplers are concerned, can only be approximated. For accurate sampling, each sampler must be calibrated periodically. This is effected without interference to regular

operations, by what is known as the brine method. A 50-gal. barrel is filled with saturated salt solution (NaCl) and placed on a platform scale. A valve near the bottom of the barrel and a piece of hose are provided so that brine can be run at a fairly uniform rate into the pulp ahead of the sampler. First a sample is obtained from the regular sample cut taken by the sampler and set aside for "blank"—that is, determination of the chlorine content of the natural pulp water. The barrel of brine is then weighed, and the brine run into the pulp for a period ranging from five to twenty minutes, determined with a stop watch, at the end of which the barrel is again weighed.

During the period noted the sample cut by the sampler is collected separately. The "blank," the sample, and a portion of the brine solution are analyzed for chlorine. The sample is weighed, its pulp density determined, and from the data so obtained the ratio of the sampler is computed.

The automatic distributors used in the mill were also developed at Austinville, Va. As shown in Fig. 5, they consist of a fixed cylindrical tank, 32 in. in diameter, divided into equal compartments, the number depending on the number of pulp streams desired. Above the tank, mounted upon a ball thrust bearing, is the distributor head, from which project six street elbows and nipples, spaced 60 deg. apart.

Pulp to be divided is fed into the center of the distributor head from a vertical pipe, whence it flows out through the six elbows and nipples, which are all inclined in the same direction, thereby causing the distributor head to rotate slowly by reaction. The pulp is delivered in equal portions into the compartments of the fixed tank, from which it is piped to various pieces of equipment for treatment. The nipples contain bushings of rubber or porcelain of a diameter that will result in the distributor head being kept about half full of pulp.

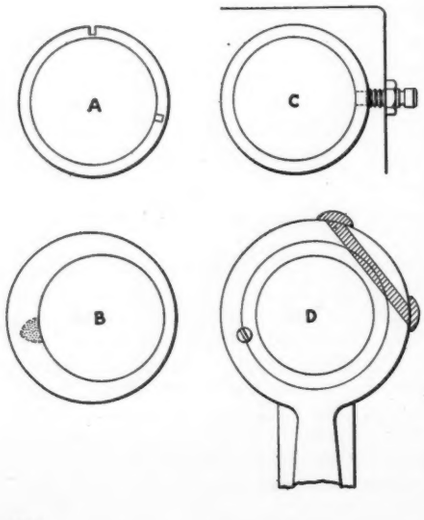
Seven distributors are used in the mill: one five-way, to feed the five roughing tables; one four-way, to feed table tailing to the four Marcy mills, and five two-way to feed the second and third zinc rougher cells, the two sets of first, second, and third zinc cleaner cells, and the two decks of the cleaner table.

■ ■ ■

Bronze Bushing Repairs

BRONZE BUSHINGS used in mine, mill and smelter equipment wear rapidly and must be replaced frequently, writes Charles Labbe, Death Valley Junction, Calif. If spares are not available, and if the shop is not equipped with a lathe for turning new bushings, a shutdown is unavoidable. By the methods described in the following however, worn or loose bushings may be rendered serviceable at little cost:

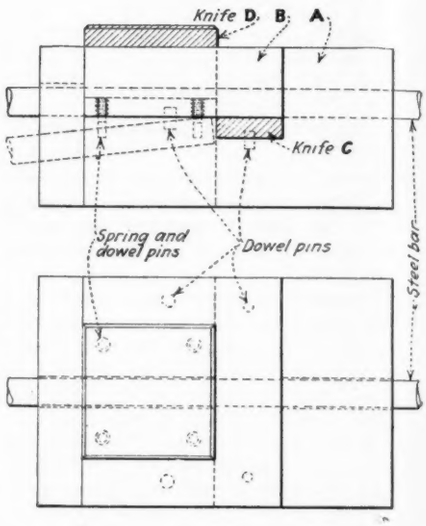
Piston-pin bushings worn only a few thousandths of an inch may be reconditioned by applying a thin coat of solder to the exterior surface. When pressed back into the shell the extra pressure caused by the slightly increased diameter will close the bushing sufficiently to reduce the play between pin and bushing bore. In pressing back the bushing, the edge of the shell hole should be filed smooth, to keep the solder from scraping off. Bushings are best removed, after the amount of play has been determined, with a simple puller consisting of a strong bolt and a set of washers.



Bushings worn more than 0.0010 in. are repaired as shown in *A* in the accompanying sketch. Two small slots are cut with a hacksaw at the points indicated, and the bushing is pressed back with a carefully fitted shim. Loose bushings may result if the slots are cut too wide, or if the bushing is accidentally cut through. This can be rectified by soldering the severed parts or by putting solder or babbitt in the slots, to restore the original exterior press-fit dimensions of the bushing.

Badly worn bushings can be repaired by babbitting the worn bore. The bushing is bored out roughly, then babbitted and finished in the lathe or drill press. When babbitting long bushings, the following rules should be followed, to avoid holes caused by shrinkage: First, the bushing must be kept in a true vertical position; second, the molten babbitt must be poured and added to the visible shrinkage while the upper part of the bushing is being heated gently with a blowtorch. In this manner an uneven distribution of the babbitt is prevented, as the lower part of the bushing is allowed to cool first.

Difficulties are often experienced in reaming out unevenly babbitted bushings in a drill press. The drill will invariably follow the eccentrically located bore, making the bushing useless. This can be overcome by providing a small cut, or channel, to guide the drill, as indicated in *B*. Loose bushings are secured by the use of a setscrew, as shown in *C*, or with a riveted brass pin or short stud placed between the bushing and the bearing shell, as in *D*.



Cutting Drill Steel

TO DO AWAY WITH the cutting of drill steel with a cold chisel and sledge—a laborious, unsafe, and time-wasting procedure, A. Y. Smith, master mechanic at the Pilares mine of Moctezuma Copper, Sonora, Mexico, developed the simple and inexpensive drill-steel cutter shown in the accompanying sketch. The device consists of the sturdy, forged and machined mild-steel base *A*, with the guide piece *B*; and the knives *C* and *D*, made of tool steel. Knife *C* is stationary in the groove traversing the base *A*, and knife *D* rests on four small springs between the guide pieces *B*. All parts are kept in perfect alignment by a series of dowel pins placed at different points, as illustrated. Using a steam, or air, hammer, cutting of the inserted drill steel bar is a matter of seconds, as the sharp blow by the falling hammer on the cutter *D* instantaneously severs the bar at the marked point.

Pioneer Gold:

British Columbia's Potential Bonanza

Ira B. Joralemon

SINCE its discovery in 1897, the Bridge River area, in the Lillooet mining district of British Columbia, has attracted spasmodic interest. For 27 years rich stringers of gold ore were occasionally mined near the surface in the Pioneer, Coronation, and Lorne properties, and were treated inefficiently in arrastres and small stamp mills. Costs were high and the ore was discouragingly spotty. The 55-mile road from the railway over a terrific mountain grade was impassable during the winter. Even the station of Shalalth, on the little government-owned railroad with the ambitious name of Pacific Great Eastern that winds a precarious way inland from Howe Sound among the glacier-covered spires and green lakes of the majestic Coast Range, seemed like the end of the world to the few hunters who ventured the all-day ride from Vancouver.

In spite of early favorable comments by Alan M. Bateman and other visiting engineers, little serious development was carried on before 1924. Two options on the Pioneer by Canadian companies had resulted in failure. It looked as though Bridge River would be left forever to the bears, deer, and elk that wander into its beautiful wooded canyons from their still wilder haunts in "The Caribou."

But David Sloan had seen the Pioneer and thought he could make enough out of the bunchy ores above the 200 level to pay for deeper development. He succeeded in raising a fund of $16,000, only half of which was actually needed. With this small start, the 30-ton amalgamating mill left by earlier unsuccessful operators yielded enough gold to sink a new underground shaft from the tunnel to the 500 level; open up the third and fifth levels for stoping; and build a 100-ton cyanide mill, with agitation, run by water power from the near-by Cadwallader Creek. Ore on the fifth level had improved so much that with the 100-ton mill completed the worst of the troubles were over. Water shortage forced the mill to run at part capacity for much of the year. In spite of this, production increased to $171,000 in the year ended March 31, 1929; $180,000 in the following year, and $350,000 in the year ended March 31, 1931. For the past five months it has averaged more than $50,000 per month.

Profits from 1928 to 1930 paid for 500 additional feet of shaft, 1,270 to 1,630 ft. of drifting on the 6th, 7th, 8th, and 9th levels, and an efficient 600-kw. hydro-electric power plant on the South Fork of Bridge River. In addition, the company was placed on a regular annual dividend basis of 12c. per share early in 1931.

Meanwhile, the British Columbia Power Company had built a good automobile road, kept open all the year, from Shalalth over the mountain to a dam site on Bridge River 30 miles below the mines. Transportation and power difficulties were over. A good little sawmill, owned by the mine, furnishes timber at low cost. In spite of the location that seemed so formidable a few years ago, the Pioneer is now mining and milling ore at a cost that can well be envied by any 100-ton gold mine in Canada.

Mr. Sloan has done all this with no new capital save the $8,000 advanced on a forlorn hope in 1924. This is one of the finest examples of efficient planning and management in recent mining history. It is a good omen for the stockholders to have him continue in charge.

The geology of the Bridge River area and the early history of the Pioneer mine were described by W. S. McCann in Memoir 130 of the Canadian Geological Survey in 1922. Although most of the surface was covered with soil or glacial detritus and underground workings were few, Mr. McCann's paper is still an excellent guide to the district.

The main geological feature is an intrusion of augite diorite that cuts through the Bridge River area for many miles, with a general course of northwest to southeast. Though as a whole nearly straight, in detail the intrusion is very irregular. Instead of one continuous dike, it consists of several long lenses, sometimes connected and sometimes separated by bars, or roof pendants, of the intruded sedimentary rocks. Successive lenses are usually offset *en echelon* to the right. The two properties in which valuable orebodies have been developed — the Lorne and the Pioneer—include nearly all of one of the largest bodies of diorite, which is about three miles long and 300 to 500 ft. or more wide. The principal Lorne orebody is near the northwest end of this lens and the Pioneer deposit near the southeast end.

At the Pioneer, the intruded rock north of the diorite is the Bridge River series of metamorphosed, much contorted sediments, called Pennsylvanian by McCann. The rocks on the south are the Upper Triassic limy shale and greenstone of the Cadwallader series. For several thousand feet along the southern contact, opposite and west of the Pioneer orebody, is a belt of serpentine between the diorite and the Cadwallader sediments. This is an altered basic volcanic rock. Further west the serpentine disappears, and both walls of the diorite are of the Cadwallader series. The contact between Bridge River and Cadwallader sediments north of the intrusion is hidden by gravel and soil.

The sediments and the serpentine are soft, forming gentle slopes and the bottom of Cadwallader Creek. Outcrops of them are few, except where the creek has cut through the glacial detritus that covers most of the surface. The harder diorite forms the cliffs or steep slopes north of the Creek. Most of the contacts must be guessed at from surface contours.

On the surface, the augite diorite, particularly near the end of the various lenses, contains so many included fragments of shale, greenstone, and serpentine that it is hard to say where the intrusion ends and the sediments, with minor diorite dikes, begin. The diorite between inclusions is often so fine-grained that it resembles the greenstone. In the center of the intrusion many floating remnants of sediments remain, but the diorite becomes coarse-grained and unmistakable.

The form of the intrusion and the great number of inclusions prove that the present surface is practically at the top of an extensive diorite batholith that stoped its way up into the sedimentary series. Erosion stripped away the soft covering of shale, greenstone, and serpentine from the upper projections of the batholith, and was halted by the harder igneous rock. If the surface were a few hundred feet higher, only narrow dikes of diorite and very irregular, narrow veins with occasional gold-bearing streaks would be exposed. In all probability, the Pioneer orebodies would then never have been discovered.

Dikes of an acid intrusive rock

identified by McCann as albitite cut the diorite and the shale of the Cadwallader series. This is a fine-grained white rock, usually with small porphyritic crystals of quartz and feldspar. Often, as noted in the Survey report, the albitite comes in narrow dikes accompanying the veins. Larger dikes, sometimes several hundred feet wide, cut across the diorite from north to south. The largest of these cross dikes is exposed in the deeper Pioneer levels just west of the shaft, with a steep westerly dip. The albitite is always pyritic, and as a result is kaolinized, iron stained, and soft on the surface. It is almost always hidden by soil or detritus. As fine-grained varieties of the augite diorite and the shale are often pyritic near veins, and highly bleached and altered at the surface, the identification of albitite is sometimes uncertain. Fortunately, it seems to make no difference in the size or value of the veins whether the walls are diorite or albitite.

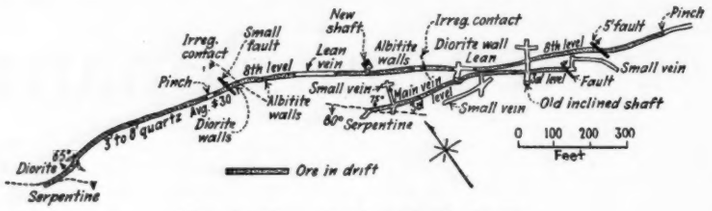


Fig. 1—Plan of 3d and 8th levels

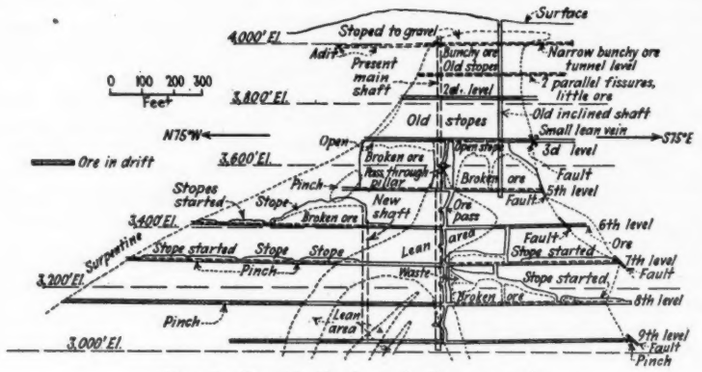


Fig. 2—Longitudinal projection on vein

In the Bridge River area the orebodies are in narrow but persistent quartz fissure veins cutting the diorite or albitite. A few of the stronger veins continue into the shaly Cadwallader sediments. But where the walls are shale the veins split into irregular, small branches, with very spotty assay values.

The Pioneer vein was found by sluicing away detritus that carried placer gold. It is near the southern diorite serpentine contact. This contact, which here is almost straight, strikes north 55 deg. west, dipping steeply southwest. The vein strikes north 75 deg. west, bending at the west end to a nearly due west course. It generally dips 75 deg. north, though locally it is as flat as 50 deg., or overturned to a steep southerly dip. At the east end the vein becomes very small, and on upper levels, at least, branches into two or more stringers. More ore may be found further east. A small cross fault cuts off the ore on the east on some levels, but on others ore has been found beyond the fault. At the west end the vein plays out completely in the soft serpentine within a few feet of the contact.

Many branches leave the vein at acute angles both on the strike and on the dip, in foot- and hanging wall. The widest ore and often the richest occurs near such intersections. Often the branches pinch within a few feet of the main vein. But some branches continue as nearly parallel veins for several hundred feet with promising assay values. A little ore was mined from one of these branch veins on the tunnel level. So far, the parallel or branch veins have been followed on the upper levels only.

Several cross faults occur with 2 to 10 ft. horizontal displacement, but no large faults have yet been discovered.

The quartz of the Pioneer vein is pure white and rather coarsely crystalline in the leaner parts of the vein. This lean ore sometimes contains fairly coarse pyrite. Richer ore usually exhibits alternate white and dark bands, the dark bands being caused partly by gouge streaks, and partly by small quantities of very fine-grained sulphides. Pyrite, arsenopyrite, and galena are common, with a little sphalerite and chalcopyrite. The total sulphide content is only about 2 per cent. Free gold can often be seen. Sylvanite is reported, but was not definitely recognized.

Green quartz and green talcy material, which is locally called mariposite and may be a variety of that mineral, often accompany the best ore. The quartz itself varies from an inch to 8 ft. in thickness and from a few cents to many hundred dollars in gold content. Silver is present only in insignificant quantities—seldom much over an ounce per ton, even in rich ore.

On one side or both sides of the quartz, and sometimes in the middle of it, are streaks of black gouge up to 2 in. thick. Other gouge seams in the somewhat bleached, pyritic, and altered rock next to the quartz usually increase the width broken in shrinkage stopes. Although the quartz averages less than 3 ft. wide, the average stoping width is about 4½ ft.

With a vein as narrow as this, the length of only 300 to 500 ft. on upper levels made the Pioneer a very small mine that would hardly pay the cost of deeper development. However, owing to the relative strike and dip of the vein and the serpentine contact, this intersection that ends the ore on the west has a 30-deg. westerly pitch. The result is a remarkable lengthening of the vein in depth, a lengthening made still more rapid by the fact that the east end of the productive portion has a pronounced, though steep, pitch to the east.

The increase in size with depth that is making the Pioneer a great mine is strikingly shown by the mine map and section. Fig. 1 is a plan of the 3d and 8th levels, showing the vein and the serpentine that cuts it off. Fig. 2 is a longitudinal projection, indicating development and orebodies on all levels. As the figures show, the length of ore is increasing by nearly 250 ft. on successive 125-ft. levels.

On the upper levels, now largely mined out, ore is said to have been continuous for the length indicated on the projection, save for local pinches. Its grade was very uneven. From the 5th level down, the best ore has split into two shoots, one following the westerly pitch of the serpentine contact and the other pitching almost straight down the dip, just east of the main shaft. From the 5th to the 7th level the part of the vein between these two main shoots is too lean and narrow to mine. On the 8th and 9th levels, the intermediate area is still rather lean, but much of it is well above the commercial limit. This, of course, helps to cause the rapid increase in stoping length as depth becomes greater.

Added to the growing size, a marked improvement in grade of ore occurs with depth. Fragmentary records indicate a grade of only about $10 per ton from the 5th level up, after dilution in shrinkage stopes. By the time the remaining ore is drawn from old stopes on upper levels the grade may be still less. Many samples taken by Mr. Sloan, adjusted upward to account for gold recovered from the mill during the development period, give an average gold content of $13 for the total length of ore on the 6th level, $19 on the 7th level, and $20.50 on the 8th level. The grade

of ore thus far developed on the 9th level is $15.20, with over 700 ft. still to go to the west before serpentine cuts off the ore. If this ore is like that found from May to August at the west end of the 8th level, which averaged about $30 per ton over 5 ft. width for the last 480 ft., the 9th level will be even better than the 8th.

The accompanying table shows the growth in size and grade of the orebody. The grades given are adjusted to the average stoping width of 4½ ft.

The 5th level west drift stopped at a local pinched area, shown by the stope below to be only a few feet long. It should develop 230 additional feet of ore before encountering the serpentine. The 9th level should have from 700 to 800 additional feet of ore.

In all the developed ore below the 5th level the grade is $17.50 per ton, with a 4½-ft. width. The ore expected per foot of additional depth, based on the 800 level, is 54,000 tons. It should be nearly 65,000 tons per foot below the 9th level, if the serpentine contact continues on its present course. The Pioneer is therefore rapidly turning into a big gold mine, and a very rich one.

The 8th level ore is large in amount and is so rich that more than a million dollars' worth will be recovered from a 125-ft. level. Costs already obtained indicate that over three-quarters of this will be operating profit. Deeper levels should be still more productive.

The plans of the company are in keeping with the remarkable developments. The mill is being enlarged to 300 tons' daily capacity. Cyaniding with agitation, giving about 96 per cent recovery, will be the process in the new as in the old mill. A new three-compartment shaft is being raised from the 9th level to surface, and has already passed the 6th level. This shaft will be sunk 1,000 ft. below the 9th level, giving more than 2,000 ft. depth below the surface. The pipe line of the South Fork power plant was built large enough to carry water for double the power now generated. Only a new turbine and 600-kw. generator will be needed to furnish power for operations on a 300-ton basis.

This program, started in April of this year, has progressed so rapidly that it seems almost certain that it will be completed on schedule before the end of 1932. The rich ore recently found in the west end of the 8th level will make it easily possible to keep the mill recovery at its present figure of $50,000 per month from the 100-ton plant. Unless some unlikely difficulty arises, this production will pay operating costs and all construction and development charges of the new program of expansion, and will maintain the present annual dividend of 12c. per share on the 1,800,000 issued shares. All this has come from the $8,000 that Mr. Sloan raised four years ago.

The life of the Pioneer promises to be a long as well as a profitable one. At present the surface is almost at the original top of the vein as well as of the intrusion that forms its walls. The character of ore and of the occurrence promise great depth; and the rapidly increasing size and grade prove that the heart of the orebody has not yet been reached. Many hundred feet additional depth may be expected with confidence. Many thousand feet are entirely possible.

Grass Valley has shown how great a production and profit may be won from long orebodies, even in narrow veins. The somewhat similar veins of the Bridge River area are giving Canada another great gold district.

Development of Ore at Depth

Level	Length Developed, Feet	Length of Ore, Feet		Grade of Ore in Gold
Tunnel	450 (approx.)	200		
2d or 160-ft.	400	370	(approx.)	Average about $10
3d or 300-ft.	685	590		
5th or 450-ft.	630	540		
6th or 575-ft.	1,308	1,003		$13.00
7th or 695-ft.	1,628	1,258		19.00
8th or 820-ft.	1,830	1,500		20.50
9th or 940-ft.	1,270	990		15.20

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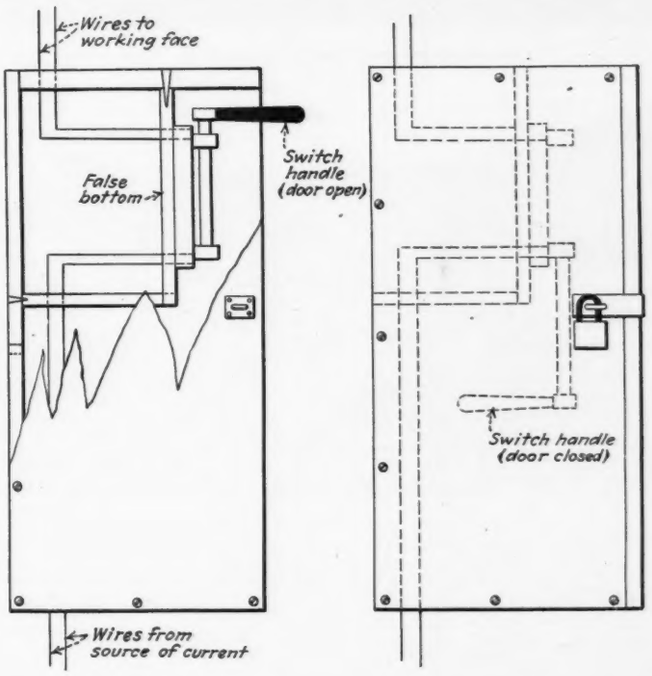
Safety Switch for Electric Blasting



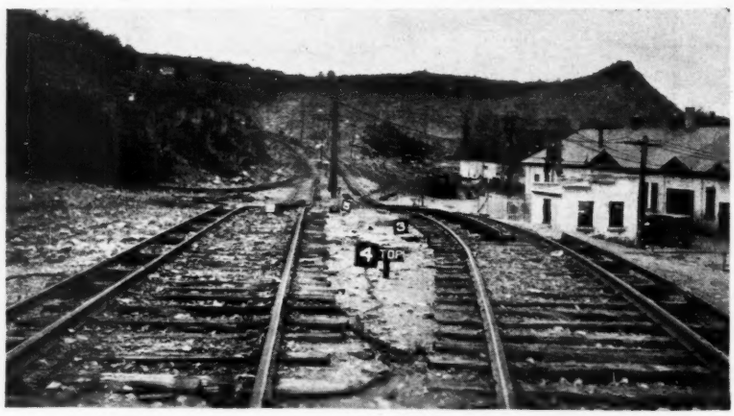
PREVENTION of blasting accidents is governed largely by care and caution in handling explosives, and by the type of protective devices provided on the surface and underground. A safe and reliable blasting switch, designed by E. W. Baker, mechanical engineer, Hope Metals Company, Winkelman, Ariz., is shown in the accompanying drawing. The novel feature in its construction is the double-pole throw-switch. This switch, with the throw handle turned at right angles to the switch blades, is placed inside a wooden box, in such a way that the door of the box cannot be closed unless the switch is first disconnected after the round is shot. Thus the contact between the blasting machine and the working face remains constantly broken. The box, made of 1-in. white-pine boards, is painted red, with a danger sign stenciled on the door. When not in use, it should be locked with a good padlock, the key of which should be kept by the man in charge of blasting. A spare key may be kept at the office for emergencies. To guard against the door's being opened by removing the door hasp, the hasp should be attached to the door with stove bolts, nuts inside, and the protruding bolt ends riveted over the nuts. Wires from the blasting machine, or any other power source, enter through holes drilled in the bottom of the box, and the contact wires to the working face leave through the top in the same manner.

OPEN-PIT MINING—II

Electric haulage for steep grades at the Volunteer mine, on the Marquette Range, in Michigan

A. H. Hubbell
Associate Editor

Volunteer pit as it appeared in May, 1931



At the Volunteer pit, Palmer, Mich. Looking down-grade from the crushing plant approach. The pit lies to the right. Note the control tower on hillside at left. Note also the markers between tracks.

UNIQUE in being the only open-pit iron mine in the Lake Superior Iron Country, if not in the United States, to have electrified its haulage by adopting the Woodford system, the Volunteer mine is situated at Palmer, Mich., 4 miles south of Negaunee, on the Marquette Range. It is operated for the Palmer Mining Company by Pickands Mather & Company. The pit was opened in 1926 and produces a siliceous grade of ore analyzing 35.16 per cent iron, natural; 0.041 phosphorus; 41.45 natural silica; and 3.67 moisture. This ore is crushed to minus 2⅜-in. size prior to shipment. Tonnage shipped to the beginning of 1930 was 1,280,177.

In size the tract worked is somewhat restricted, covering approximately 30 acres. In view of the steep grades that would be necessary, the Woodford haulage system, developed by the Woodford Engineering Company, of Chicago, for use on grades as steep as 8 per cent, was selected at the start. The track grade in the pit is frequently as high as 6 per cent and, in one instance, as much as 7. Trackage totals about 1¼ miles.

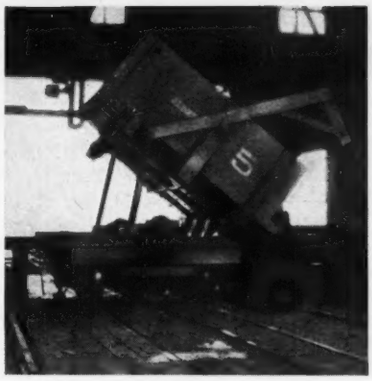
The haulage system as installed comprises eight 10-yd. remote-controlled motorized side-dump cars of standard gage, which are loaded by the shovels in the pit and run singly with their loads to the crushing plant just outside the pit about half a mile away.

The cars collect their current from a third rail beside the track, the rail being divided lengthwise into sections, insulated from one another by intervening lengths of wood. These sections may be energized or de-energized from the panels at the control points, in any of the groupings or sequences decided upon in laying out the system. To distinguish them they are numbered, the numbers being shown on markers along the track, as may be seen in one of the accompanying illustrations. Supplementing this remote control, which works through a selector switch on the car so as to drive or brake the motors as desired, is a reversing lever which projects from the side of the car and engages with stationary cams placed alongside the track wherever the conditions require the current to be reversed or shut off. This lever may also be reversed by hand.

Current is purchased from the Cliffs Power & Light Company. For use in the haulage system it is converted to 250 volts, d.c., in a 200-kw. motor-generator set, installed in the shop building for convenience. This comprises a 1,200-r.p.m., 300-hp. synchronous motor, taking current at 2,300 volts and a generator making d.c. current at 250/275 volts. A duplicate set is held in reserve.

Control of car movement at each end of the line is effected from a point at the shovel or at the crusher, as the case may be. On the main half-mile stretch of double track between the ends, it is effected from an elevated tower on a rise of ground just outside the pit,

Loaded car descending and empty ascending a 6 per cent grade leading into pit



Dumping a car at Volunteer crushing plant

approximately midway between the ends and in sight of all points on the stretch. Manually operated master controllers are used.

Each car is equipped with two 32½-hp., 250-volt, railway-type series motors, one on each axle, the two having their fields and armatures in parallel. Control of movement is effected by varying the voltage in the particular section of third rail from which the motors happen to be receiving power at the moment. This is accomplished through the master controllers, contactors, and resistances at the control station. Depending on the position of the selector switch, already mentioned, which connects the brake coils with the conductor rail, also the motors with the rail through a dynamic resistance, the power for braking or driving the motors can be varied in definite steps. The temporary braking voltage is 80, the permanent braking voltage 125, and the driving voltage 250. The reversing switch, previously mentioned, plays a part in the control, aside from direction of movement, in that if it is in position to send the car under power in a certain direction, the entry of the car in the opposite direction, on a section of track that is either permanently dead or has had the power temporarily cut off, will cause the motors to act as generators, serving to brake the car, and thus permitting controlled coasting on a downgrade.

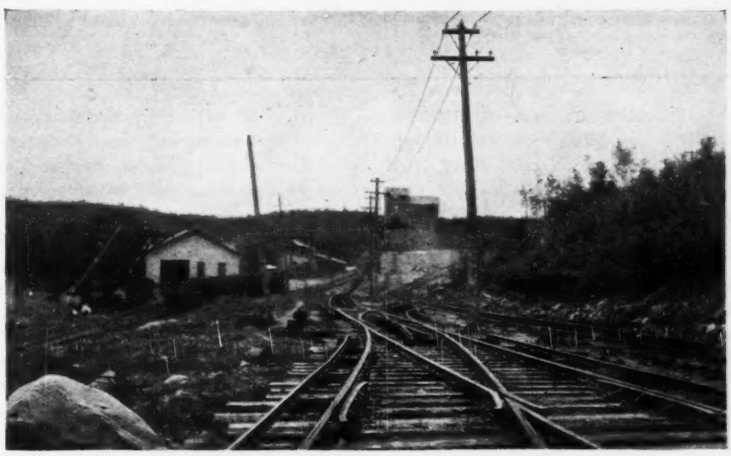
In the practical working of the system at the Volunteer, a car at the shovel is under the control of the shovel oiler, who spots it and starts it on its journey, by means of a controlling device. After leaving the section thus controlled, the cars enter the stretch controlled by the tower man, under whose control it remains until it reaches the foot of the hill, shown in the photograph, from which point it must mount the slight rise in grade approaching the crusher building. At this point it comes under control of the dump man at the crusher, who stops it at the pocket, where it is automatically reversed. At the top of the hill on this trip from the pit a reversing cam throws the switch, putting the car under dynamic braking control, under which it coasts down, making current which is not collected but thrown off as heat. Near the foot of the hill, another cam throws the reversing lever so that the braking control is off and the car runs free. If anything goes wrong on the downgrade journey, the tower man signals by siren to the dump man, who throws a track switch by means of a pushbutton and sends the car on to a safety track. Speed under dynamic braking is variable, depending on load and grade, but probably does not exceed 6 miles per hour for the worst condition.

On the return trip, when the empty car comes out of the crusher building, the reversing lever is up as far as the first reversing cam, so that the motors are taking current. Just as the car reaches the cam, the current is cut off and the cam sets the lever for dynamic braking. About 75 ft. further, the lever is again thrown to stop the braking action and the car coasts free until power must be applied on the upgrade.

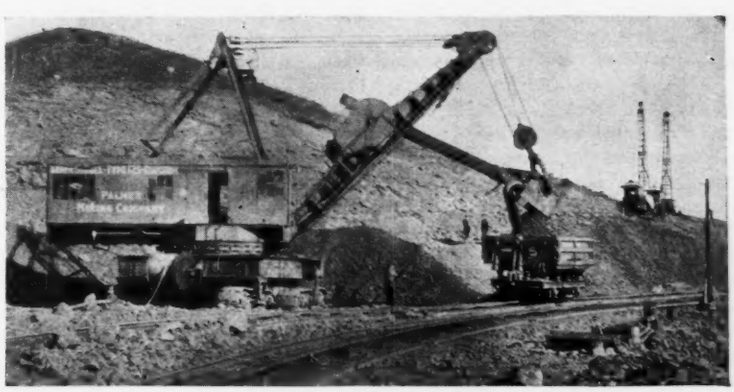
Shovel equipment includes two Model 125 Marion full-revolving, crawler-mounted electric shovels, having 4-yd. dippers, equipped with Molychrome (Westeco) teeth. The ground is hard. To break it for shoveling it is drilled and blasted. Holes are put down with six Sanderson Supercyclone drills, using 6-in. bits. The depth depends on the height of bench, but averages 45 ft., the hole being drilled 5 ft. below the grade of working elevation. Holes are spaced 15 ft. along the bench and 13 ft. back from it. Forty, 60, and 80 per cent gelatin are used in loading, but mostly 60. Where the holes are column-loaded, 40 per cent is used. When the ground is extra hard and the toe is heavy, it is customary to use about 100 lb. of 80 per cent in the bottom of each hole. Chambering is not practiced, being thought to crack up the ground so much that the gases escape too readily in subsequent blasting.

The number of holes to a blast varies. For the largest blast shot at the Volunteer, 535 were drilled, breaking 630,000 tons. The average blast approximates 315,000 tons. Holes are shot simultaneously or practically so, Cordeau-Bickford being used in the manner developed on the Mesabi and elsewhere.

At the crushing plant, a 27½-hp. 250-volt motor-driven hoist is used to dump the cars, picking up the bodies with two hooks and dumping them directly into a 48-in. Traylor gyratory crusher set to 6 in. This discharges onto a conveyor, delivering to a 2⅜-in. grizzly, the oversize of which goes to two 20-in. Traylor gyratories set to 2⅜ in. The product of these is final, going to a conveyor where it joins the undersize from the grizzly, both then going into the loading bin.



Looking toward the crushing plant at the Volunteer



Loading a car at the Volunteer

Lead Poisoning Checked in Australia

PLUMBISM (lead poisoning), with the exception of silicosis and similar lung affections, ranks as the most serious occupational disease in all the ramified branches of the mining and metallurgical industry. But, although silicosis is inherently most difficult to combat—and will remain so while mineral-bearing material has to be drilled, blasted, and removed in confined spaces—plumbism, because it becomes manifest within a comparatively short period, and has well-defined and easily recognized signs and symptoms, can be placed under control without loss of plant efficiency. As a matter of fact, if the remarkable result achieved at Port Pirie, Australia, be any criterion, full success in the elimination of plumbism will consequentially give greatly increased technical efficiency.

Since 1925, the problem of reducing the incidence of plumbism among employees of the Broken Hill Associated Smelters, at Port Pirie, has been continuously and thoroughly investigated. The plan of campaign has been to study the working conditions at each locality where a man who has contracted plumbism has been at work, and to decide forthwith the alterations necessary to effect improvement. In many instances, these alterations have been simple and inexpensive, whereas in others a huge expenditure has been called for, particularly so when the improvement was primarily designed to advance metallurgical technique. This plan, which has been administered by an Industrial Health Department, has given success beyond all expectations. For the half year ended with December, 1925, complete governmental records show that 131 cases of plumbism prevailed among 2,615 employees; whereas, for the corresponding period five years later, only eight cases prevailed among 1,500. Of the eight cases, but five were new ones; three contracted poisoning after having been cured previously. Thus, during the quinquennial period, the percentage of plumbism cases decreased from 5.01 to 0.53 per cent. Many of the alterations in equipment and procedure have not yet become fully effective, and a still further decline in the plumbism rate may be anticipated.

Plumbism is accepted as signifying a condition of pronounced ill-health resulting from the absorption of lead. Lead may enter the body along three recognized channels: (1) by inhalation as dust or fume, in which instances the lead is rendered soluble in the respiratory tract; (2) by swallowing, as in eating food with dirty hands or drinking from dirty containers, when digestion effects solubility; and (3) but less common, by prolonged contact of the skin with lead-bearing materials, such as sinter and drosses. When absorption exceeds elimination by the excretory organs, lead gradually accumulates and poisoning follows. In general, the healthier the employee, the longer the time before lead poisoning occurs, but some have shown themselves predisposed to attack, whereas others remain immune.

The usual symptoms of plumbism at Port Pirie are anaemia, headache, loss of appetite, wasting of the fatty tissues, wasting of muscles and muscular weakness, lack of mental energy, abdominal colic, and constipation. Cases of plumbism may be grouped under one of three types: (1) gastrointestinal plumbism, in which the main symptoms are colic and constipation; (2) nervous plumbism, indicated by loss of muscular action; (3) cerebral plumbism, in which the brain is affected and the sufferer is subject to fits and loss of reason.

Attention was first directed to the prevalence of plumbism at Port Pirie by a Royal Commission, which issued a detailed report in 1925. Weekly production at the time of investigation was 2,600 tons of market lead, 130,000 oz. of silver, 50 oz. of gold, 5 tons of litharge, and 30 tons of hard (antimonial) lead. The commission found that an increase in the plumbism rate had occurred in the years preceding its examination, and stated that the principal reasons for this increase were: (1) A greater tonnage of lead-bearing material was being treated. In 1925 the tonnage handled was double that treated in 1915. (2) The physical character of the Broken Hill lead concentrate had changed, owing to the inclusion of a greater proportion of slime flotation concentrate. This was a consequence of improved ore treatment at Broken Hill. (3) The number of Southern Europeans on the payroll had increased. These men, in the main, according to the report, did not thoroughly understand the hazard, and, having a lower standard of living, were more susceptible to attack.

The commission considered that the predominant cause of plumbism was the inhalation of lead-bearing dusts and fumes. Accordingly it strongly stressed the need for preventing dust from contaminating the atmosphere by such means as: (1) providing exhaust hoods over furnace discharges; (2) improving and wetting the roads in and around the smelters; (3) inclosing conveyors, damping material being conveyed, and removing conveyor spillage as frequently as practicable; (4) cleaning floors, walls, and rafters of buildings. The Huntington-Heberlein system of blast roasting was considered by the commission to constitute a definite

Table I—Lead-Poisoning Cases, 1924-30

Six months ended	July 2, 1924	Dec. 31, 1924	July 1, 1925	Dec. 30, 1925	June 30, 1926	Dec. 29, 1926	June 29, 1927	Dec. 28, 1927	June 26, 1928	Jan 2, 1929	July 3, 1929	Jan. 2, 1930	July 2, 1930	Jan. 14 1931
Total number of daily employees	2,552	2,615	2,356	2,660	2,636	2,550	2,320	2,060	1,910	1,750	1,680	1,600	1,560	1,500
Average daily number of employees	1,595	1,601	1,698	1,750	1,673	1,690	1,650	1,570	1,500	1,480	1,430	1,400	1,350	1,190
Number of plumbism cases	103	131	130	48	60	38	29	54	48	43	34	16	15	8
Number of cases expressed as per cent of total number of employees	4.04	5.01	4.55	1.80	2.28	1.49	1.25	2.68	2.50	2.46	2.02	1.00	1.10	0.53

Table II—Lead-Poisoning Cases Classified According to Length of Service

Period of Employment	Number of Cases 1926–27	Number of Cases 1927–28	Number of Cases, 1928–29	Number of Cases, 1929–30	Number of Cases, July 2, 1930–Jan. 14, 1931
Under one year	19	29	17	2	.....
Over one and under two years	Not available	17	12	7	.....
Over two and under four years	Not available	31	24	7	.....
Over four and under eight years	Not available	13	18	10	8
Over eight years	Not available	12	6	5	(Between four and seventeen years)
Total number of cases	67	102	77	31	8

Contributed by a competent and qualified Australian mining engineer who, because of professional connections, is obliged to remain anonymous.

plumbism hazard, and a suggestion was made that the charge, after complete roasting in the pot, should be allowed to cool sixteen hours before tipping, instead of tipping, damping, and handling immediately after roasting. The commission favored a reduction in the tonnage treated by the H. & H. system and an extension of the Dwight-Lloyd blast-roasting plant, in which only a part of the tonnage to be blast roasted was then handled. These numerous and varied alterations, as suggested, were adopted and effected in the years immediately following the issue of the report; and together with many and more important improvements carried out during more recent years, as a result of the company's own investigations, they have brought about markedly improved working conditions throughout the smelter, and complete success in the elimination of plumbism.

From the half-yearly records published by the South Australian Department of Mines, the gradual decline in the number of plumbism cases may be followed statistically. Complete figures for the years 1924-1930, inclusive, are given in Table I, and need no explanation. The period of service of the plumbism cases is given in Table II. As indicated, the improvements in working conditions have resulted in a great reduction in plumbism among workers employed for short periods. For instance, during the six months ended Jan. 4, 1931, no case of plumbism prevailed among employees of under four years' service, and the average length of service of the cases was ten years.

The Royal Commission pointed out that a greater plumbism rate prevailed among foreign employees, particularly Greeks, Italians, and Maltese. More recent figures have substantiated this interesting fact, as Table III shows. Yet since 1928 a great reduction has occurred in the plumbism rate of foreigners.

Concurrently with the decrease in the number of cases, a diminution in the severity or period of disability of plumbism cases has taken place. Complete statistics are not available, but those that are available show that the average period of disability in 1929-30 amounted to only one-half that in 1927-28 and to less than one-third that in 1926-27. For the half year ended Jan. 14, 1931, the period of disability averaged eleven weeks, with a maximum of fifteen weeks. The decrease in the period of disability and in the incidence of plumbism among short-service employees makes evident the fact that the unhealthful working places, where employees were exposed to highly concentrated dust and fume, have been eliminated.

Departments or localities in which employees contracting plumbism were at work are listed in Table IV. This table shows that the greatest opportunities for improvement were presented on the feed floor of the lead smelting furnaces, and in the D. & L. blast-roasting plant.

Table III—Lead-Poisoning Cases Classified According to Nationality

Period		British, Per Cent	Foreign Born, Per Cent
June, 1929-June, 1930	Distribution of total employees	89.5	10.5
	Distribution of cases based on total employees	0.9	1.4
Jan.-June, 1929	Distribution of total employees	89.0	11.0
	Distribution of cases based on total number of employees	1.7	4.9
July-Dec., 1928	Distribution of total employees	88.5	11.5
	Distribution of cases based on total number employees	1.9	6.5
Jan.-June, 1928	Distribution of total employees	84.4	15.6
	Distribution of cases based on total number employees	1.6	7.4

The alterations that have brought about the markedly improved position, as shown in Table IV, are set out herewith in diary form, year by year, and the suggestion is made that Tables I and II be studied in connection with these data, so that the full effect of the alterations may be grasped:

Year ended Dec. 29, 1926

1. New storage bins erected at D. & L. machines, and improved conveyor system in operation along D. & L. storage bins. Wetting-down sprays installed above all conveyors.

2. Huntington-Heberlein pot blast-roasting section closed down during May, and all blast roasting thereafter carried out in the preroast and reroast section of D. & L. machines.

3. Baghouse of reroast section of D. & L. plant put into operation. En-route to baghouse gases pass to Green's economizer for cooling, so that the risk of ignition of the flannel bags might be reduced. Destruction and replacement of bags meant exposing baghouse operatives to lead-bearing dust and fumes. Conditions at preroast baghouse improved.

4. Nodulizing plant erected at reroast baghouse to deal with dust and fume collected in the two D. & L. baghouses and in blast-furnace baghouse.

5. Filtering capacity of blast-furnace baghouse increased 25 per cent by alterations. Exhaust hoods placed over bullion ladles and slag spouts of furnaces.

6. New retorting furnaces installed at the refinery to recover zinc from zinc crusts produced in desilverizing operations. These are a tilting oil-fired type, and, being effectively hooded, are an improvement on producer gas fired units.

7. At the bullion casting plant the fume-collecting hood much enlarged, and the height of the exhaust stack increased.

8. Preparatory work in connection with the telpher handling and transport system begun.

9. A laundry for washing overalls supplied by the company for men on special work.

Year ended Dec. 28, 1927

1. Gas-cooling equipment (Green's economizer) installed at preroast D. & L. baghouse, and this baghouse placed in full operation. Steel exhaust hoods of greater capacity erected at discharge of reroast Dwight-Lloyd machines.

2. Molten bullion transported to the refinery in 12-ton lots in ladles mounted on rail trucks. Previously bullion was cast at the copper-drossing section. Molten bullion pumped from ladles to storage kettle, from which bullion is pumped to the antimony-softening furnace.

3. Casting wheel for market lead installed, together with necessary storage furnaces.

4. Manufacture of litharge discontinued; production transferred to British Australian Lead Manufacturers at Cabarita, N.S.W.

5. Shortage of water prevented regular wetting down roads and outside storage heaps.

Year ended Jan. 2, 1929

1. At concentrate and flux storages, steam-shovel and mechanical appliances adopted to make higher heaps, thus reducing dusting and quantity of water required to keep surface damp.

2. Discharge hoppers and sinter-moistening systems on D. & L. blast roasting sections improved. Wooden exhaust stacks replaced with fibrolite-lined stacks.

3. Blast-furnace baghouse enlarged by adding two more sections, making eight sections; baghouse reroofed; and larger main from furnaces installed, giving 20 per cent greater fan capacity. In this

Table IV—Lead-Poisoning Cases Classified According to Departments

Department	No. of Cases Five Months Ended May 31, 1925	No. of Cases Six Months Ended Dec. 28, 1927	No. of Cases Six Months Ended Jan. 2, 1929	No. of Cases Six Months Ended July 3, 1929	No. of Cases Six Months Ended Jan. 2, 1930	No. of Cases Six Months Ended July 2, 1930	No. of Cases Six Months Ended Jan. 14, 1931
Ore discharge	2	..	..	..	2	1	..
D. & L. blast roasting	18	17	8	4	2	1	1
H. & H. blast roasting	10	..	..	..	..	..	..
Blast furnaces, feed floor	24	28	30	21	7	4	2
Blast furnaces, bottom floor	33	1	1	2	2	4	3
Refinery	17	5	3	5	2	3	2
Service departments	15	2	1	1	1	2	..
Zinc roasting and contact acid plant	4	..	..	1	..	..	..
Slag pit	3	1	..	..	..	..	..
Total number of cases	126	54	43	34	16	15	8

baghouse and in both D. & L. baghouses, compressed-air pipes installed and operators provided with Pulmosan-type high-pressure respirators.

4. Adjustment of blast-furnace charge and decrease in height of furnace shaft markedly reduced accretions and consequent barring and exposure of operations to highly concentrated lead fumes. Ventilation of feed-floor improved by removal of roof over blast furnaces.

Year ended Jan. 2, 1930

1. Complete telpher handling system placed in commission in January, 1929. This system has not only markedly reduced transport costs but also has been the prime cause in the reduction of plumbism cases on the feed floor of the blast furnaces from 51 per annum to an almost negligible figure. The telpher system, by which the furnace charge is carried overhead in skips and dropped into the furnace superhopper, consists of three sections; the first running along the wharf and above the coke and limestone storages, the second commanding the main storage bins, and the third traversing above the blast furnaces. The components of the blast-furnace charge are collected on a secondary telpher installation running under the discharge openings of the main storage bins and are dumped into a telpher skip of 5 tons' capacity. The skip is elevated by a telpher electric trolley and hauled along above the blast furnace feed hopper, and the contents are discharged therein. This sheet-steel hopper is of 25 tons' capacity and has four charge gates, gear-operated, on either side. The telpher transport and superhopper system of feeding displaces the truck traversing installation, in which a continuous horizontal rope hauled hopper-bottom trucks from elevated storage bins along and above the blast-furnace feed floor. The new system has effected a great reduction in the number of operatives required on the feed floor, and has provided much improved ventilation of both top and bottom floors.

2. Charge-handling conveyors of D. & L. machines improved, and dusting and spillage thereby being reduced. Crushing plant, in which preroast sinter is crushed to ¼ in. before being reroasted, reconstructed and new smooth-faced roll crushers installed.

3. Leaching and precipitating plant erected to remove cadmium from all smelter baghouse fume (but not D. & L. fume). Fume from baghouse hoppers sluiced to agitating vat and then vacuum filtered. To filtrate sodium carbonate is added precipitating cadmium carbonate, which is removed by filtration and dried for dispatch to Electrolytic Zinc Company. Residue from leaching is returned to blast furnaces.

4. At the refinery, antimony softening improved, resulting in less dross being formed and consequently less material to be rehandled. Antimony softening, carried out in a reverberatory furnace, is continuous, molten lead being fed and antimonial litharge run off without stoppage for charging.

5. Newnham kettle, in which market lead is stored for casting, hooded.

6. Improved eating rooms; washing and lavatory accommodation provided. Laundry handled 900 overalls weekly.

Year ended Jan. 14, 1931

1. Blast furnaces fitted, at feed floor, with water-cooled hoods. Distortion of hoods by heat of furnace eliminated, and fumes from top of charge more efficiently collected. New downtakes installed to carry away fumes.

2. Portable cover-plates provided to be placed over the top of a blast furnace when furnace is being run down, prior to barring accretions. Upcast stacks provided along bottom floor of blast furnaces to carry away fumes. Hoods of bullion and slag discharges made more effective.

3. In the refinery, continuous zincing for gold and silver recovery adopted. In the operation of this new system much less dross has to be rehandled, and the method is quicker and gives great economies in fuel and labor.

4. In recovery of zinc by distillation of zinc-silver alloys, cast-iron retorts adopted, replacing clay retorts. Larger cupellation furnaces of reverberatory type installed, and fuming greatly reduced.

Since 1925, Associated Smelters has been regularly inspected at monthly intervals by a member of the South Australian Department of Mines, and the full cooperation of the company's Industrial Hygiene Department with this officer has been an important factor in improving the operating conditions. The employees have also been represented by two Workmen's Inspectors, and these have made frequent inspections and furnished reports for the consideration of the company.

In stamping out a persistent health hazard within five years, the Broken Hill Associated Smelters, which today has an annual output of 175,000 tons of lead and 270 tons of silver, has made a remarkable achievement in industrial hygiene. And in the adoption of the telpher system of transport and furnace feeding, continuous softening of lead bullion, continuous gold and silver zincing, and removal of cadmium from flue dust has contributed generously to metallurgical development.

Experience at Port Pirie has shown that in lead smelting the prevalence of dust and fume in and around localities where operatives are at work is certain to give rise to plumbism. Given adequate prevention and collection appliances for dust and fume, no man-handling of sinter and furnace charges and drosses, no dusty roads, no poorly operating smelting furnaces, and ample washing facilities, plumbism, as a health hazard, will not exist.

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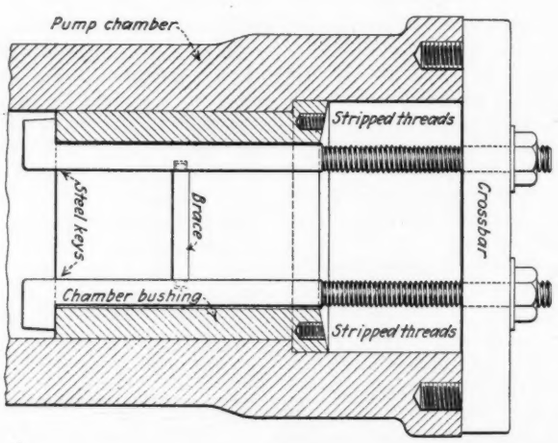
Plunger Pump Repair



ONE of the difficulties encountered in repair of plunger pumps is the extraction of worn pump-chamber bushings. Removal of the brass bushing is generally effected with two threaded steel rods, screwed into the threaded holes of the bushing at one end, and at the other end attached to a sturdy crossbar, traversing the pump-chamber flange. This procedure, however, cannot be applied to carelessly pressed-in, or "frozen," bushings, as the excess pressure required to loosen the bushing gradually strips the threads of the bushing holes. In such a case the bushing may either be drilled out, a slow procedure requiring special drills, or the simple arrangement shown in the accompanying illustration may be used. This consists of two long, threaded steel keys, a small brace, and a crossbar resting on the chamber flange.

Asbestos in Vermont

Francis A. Westbrook

PRODUCTION of asbestos by the Vermont Asbestos Corporation has been under way since early in 1929, and sales have been increasing in spite of the adverse general business situation. The existence of asbestos in the serpentine rock making up much of Belvidere Mountain at Eden, Vt., about 25 miles south of the Canadian boundary, has long been known. Various attempts have been made to work it, but these have been unsuccessful until recently, owing to market conditions and to lack of capital and power.

Mill of Vermont Asbestos Corporation

The property, of approximately 600 acres, was acquired in 1927 by the company, a new organization controlled by strong financial interests in Boston. Exhaustive studies were made of the deposit and of possible uses for the grades of asbestos consisting of fiber of shorter than spinning length. This research showed that the uses for these grades were multiplying, that a milled fiber of high quality could be produced which would be acceptable to the trade, and that the favorable geographical location would permit the sale of the product in most United States markets at several dollars a ton less than the competitive Canadian asbestos.

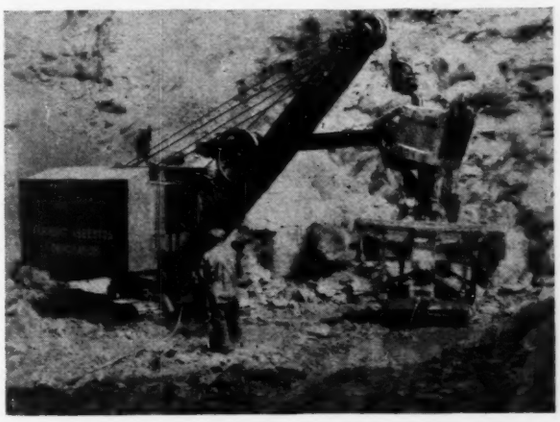
Decision was made, therefore, to rehabilitate the plant and to build an up-to-date power line about 25 miles long from Fairfax, Vt., to assure an adequate and uninterrupted supply of power. The services of engineers experienced in the Canadian asbestos districts were secured, and under their direction the property was completely revamped. New equipment was added and the old repaired.

The mine is on the south side of Belvidere Mountain at an elevation of 2,500 ft. and approximately fifteen miles from the nearest railroad station at Hyde Park, Vt. A private road links the property with the main highway. An important improvement was the erection of a warehouse at Hyde Park. This has made prompt shipments possible irrespective of delays in transportation between mine and shipping point caused by weather conditions at certain seasons. A fleet of light trucks has been purchased to carry the finished fiber down the mountain to Hyde Park and to bring in supplies on the return trip. In addition, the road was improved and a tractor snowplow acquired, thus reducing wear and tear on the trucks to a minimum.

The operation of mining, or quarrying, is simple, the workings being on the side of the mountain. Drilling is done in benches with Sullivan and Ingersoll-Rand jack hammers in an open quarry the face of which is approximately 125 feet high. Work is carried on all winter. Little stripping is necessary, as the rock outcrops at this point. Benches are usually 12 to 15 ft. high. Blasting is done at the close of the day's work. Large fragments are reduced by blockholing to sizes small enough for a 1¼-yd. shovel (Marion electric), which loads it in 5-ton side-dump cars. These are hauled along almost level tracks by a Flory electric hoist to the primary jaw crusher, a Traylor 24x36-in. unit, driven by a 100-hp. motor. The rock is crushed to approximately 5- or 6-in. size and is discharged to a 36-in. belt conveyor, 100 ft. long, which delivers it to a 1,000-ton steel-lined wooden bin.

From the storage bin the rock is drawn off through a gate by gravity into the secondary crusher. This is a 13x30-in. jaw-type unit of Farrel make and reduces to 3- or 4-in. size. The crushed product is delivered by a 20-in. belt conveyor, 50 ft. long, to a hopper from which it is fed into two rotary cylindrical dryers (Traylor 40 by 6 ft.) for removal of free moisture. It is a prime necessity to have the raw rock dry before attempting to separate the fiber. The dryers are heated by hard coal or coke, depending on the weather conditions. The rock then drops into two gyratory crushers (Traylor 4½-in. finishing), which reduce it to 1-1½ in. size. It is now ready for the milling processes by which the fiber is separated from the serpentine. The three crushing operations cited and the drying take place in separate buildings. The product of the tertiary crusher is conveyed to a

Asbestos warehouse at Hyde Park, Vt.



Shoveling asbestos rock in pit on side of Belvidere Mountain

500-ton reserve bin, built of heavy planking and carefully protected from the weather to keep it dry, as well as lined with steel plates. This is situated between the crusher house and the mill building, the latter being at the lower level. The ore enters the mill by a bucket elevator at the top floor and thence flows by gravity to the lower floors, finally emerging as finished product at the truck-loading platform on the lowest floor. From quarry to platform no manual handling is required.

In the mill the rock passes through a series of jumbos or fiberizers. These consist of cylindrical drums, each having a central shaft equipped with arms having shoes on the ends. The rock is crushed against the sides of the cylinders by these shoes and the fiber separated and fiberized. From this point on, the milling consists of screening and air separation of fiber from rock by means of suction, rescreening, and further separation, until the desired grades and cleanness are obtained.

The amount of waste is very large, as a 6 per cent yield of fiber is considered high. Refuse from the fiberizing operation drops through chutes to an 18-in. belt conveyor (Link-Belt) 300 ft. between centers, and is carried to the dump on the mountain-side. It has little commercial value at present.

The fiber, after passing through dusters and graders, falls into bins according to length and is bagged by hand in 100-lb. burlap bags. Three grades are produced: "Shingle" fiber, testing 0-2-10-4 or better, used in making asbestos shingles, lumber, and corrugated sheets; "XX" fiber, testing 0-0-10-6 or better, used in the manufacture of asbestos paper, millboard, molded brake linings, and clutch facings; and "C" fiber, testing 0-0-5-11 for making roof-coating compounds, fibrous paints, plastics, various molded products, and boiler covering cements.

Plant capacity is approximately 500 tons of raw asbestos-bearing rock per nine-hour day. As a result of the perfection of the mechanical equipment, few men are required in the processing.

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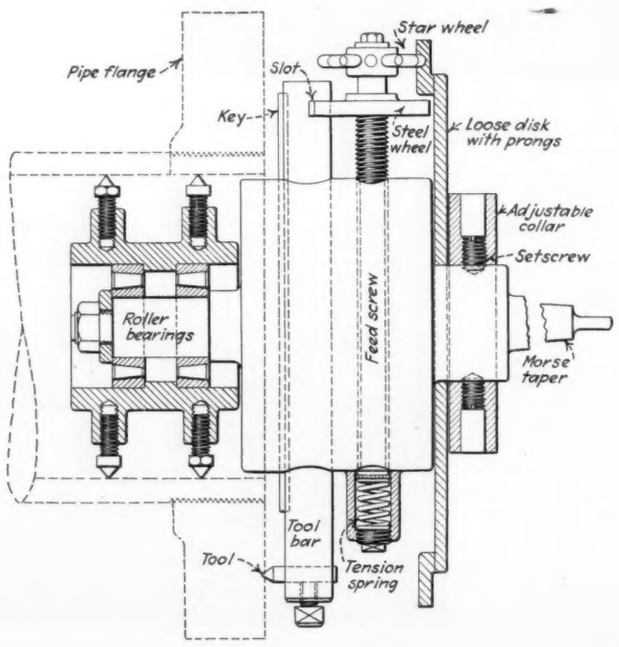
Portable Pipe-Flange Facing Tool

DAMAGE to the ends of pipe flanges frequently occurs during the construction of a pipe line, or during the transport of pipes from the factory. If leak-proof joints are to be insured, repairs must be made at the local machine shop. The method commonly employed is to remove the flanges from the pipe by hand, and reface them in the lathe, a long and costly procedure. F. J. Martin, master mechanic, Miami Copper, Miami, Ariz., recently faced with the repair of a large number of damaged flange ends on a 12-in. high-pressure line, solved the problem successfully with a specially designed, portable facing tool, shown in the accompanying sketch. This tool consists of a revolving body, housing the movable tool bar and the feed screw with tension spring and two steel drive wheels, a loose disk with two contact prongs, and an adjustable collar held by two setscrews; and a stationary end bearing, containing two sturdy roller bearings and eight telescopic, tempered screws to facilitate centering. Motive power is furnished by a small pneumatic or electric drill attached to the taper end of the revolving body. Operation of the unit is simple: The end bearing is placed in the pipe, and the revolving body is carefully aligned with the screws. Next, the cutting tool and bar are adjusted. and the disk with the two prongs is blocked with a light wooden pole. The drilling machine is then started and the cutting tool advanced slowly to the flange face. After the first guide cut, the tool bar is advanced automatically by the star wheel and the flange-like wheel revolving in a small slot at the end of the bar on the feed screw, controlled by the two stationary prongs.



The concentric grooves, required on flanges used for high-pressure lines, can be cut with this device in a similar manner by using a diamond-point tool instead of the standard cutting tool.

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Design and Care of Bucket Elevators

IN SELECTING a bucket elevator for any specified purpose, the material to be handled during a given time should be known, so that maximum efficiency in service may be obtained, writes Ralph McMillan, construction superintendent, Link-Belt Company, Chicago, Ill. If future expansion is expected, provisions should be made to take care of anticipated capacity. Sufficient room in the elevator casing is essential to long life, as ample space does away with the wear of the buckets on the casing. Elevator pits should be large enough to allow quick and easy access for adjustment, cleaning the boot, and lubrication.

Where elevators of the centrifugal-discharge type are used, the receiving point should be well above the foot shaft, so that the major portion of the material may be discharged directly into the buckets. A uniform feed is essential; the elevator will choke and stop if overloaded. This also applies to continuous bucket elevators. A discharge chute of ample proportions is also an essential requirement. It must be placed at a proper angle, to insure immediate release of the material, without danger of backing up to the line of buckets.

Best operating results are obtained with a positive drive, of which type a variety of compact, efficient models are available. Use of these drives is a great aid in reducing noise and vibration. Lubrication is best taken care of by pressure systems and by the use of take-ups and pillow blocks with ample grease and oil-storage facilities. Drives running in oil and or dust-tight casings give longest service.

Geological Indications at Kirkland Lake

R. D. Hoffman

KIRKLAND LAKE is now the premier gold camp in North America and gives promise of maintaining and perhaps exceeding its current rate of production of over $20,000,000 yearly for many years. Those who desire detailed knowledge of the camp I refer to three excellent reports published by the Ontario Bureau of Mines, Parliament Buildings, Toronto. These reports are: "Kirkland Lake and Swastika Gold Areas," by A. G. Burrows and P. E. Hopkins, Vol. 23, Part II, 1912, pp. 1-39; "Kirkland Lake Gold Area," by A. G. Burrows and P. E. Hopkins, Vol. 29, Part IV, 1920; and "Kirkland Lake Gold Area," by E. W. Todd, Vol. 37, Part II, 1928. In addition, excellent statistical tables have been prepared by W. R. Rogers, which have been similarly published in yearly reports of Ontario Bureau of Mines.

These notes are based on field work and repeated visits to the camp since 1921. If they have any merit, the credit is due entirely to my former partner, the late Capt. H. C. Anchor. Anchor, an old Western prospector, was a natural born geologist and could carry a picture of the entire structure of a mining area in his mind. It was Anchor who, when working over the area with me in 1921, outlined the basic ideas expressed here and emphasized the importance of the structure. "As the rocks go, so the ore." Anchor's ideas were based on his knowledge of the camp from its beginning to 1923, so that here together we bridge the entire life of the camp. In following the ideas presented, the two maps, Fig. 1 showing the distribution of the veins on surface and the other, Fig. 2, showing a longitudinal section, will be found useful.

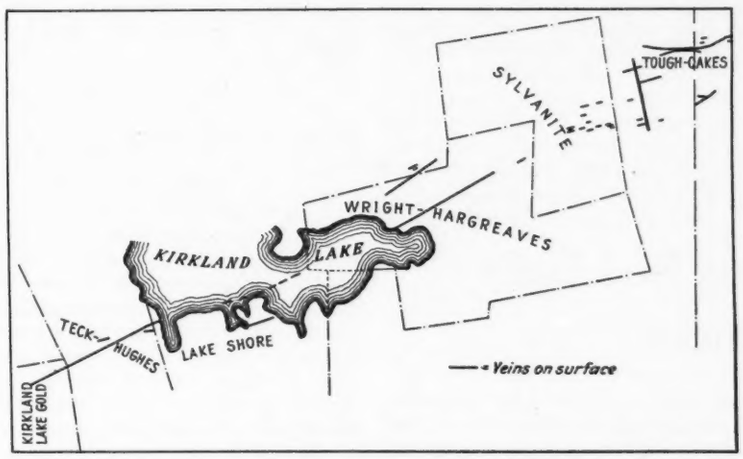

Fig. 1—Kirkland Lake gold area, Ontario. Heavy lines show veins on surface. From Ontario Department of Mines Report by A. G. Burroughs and P. E. Hopkins, Vol. 29, Part IV, 1920

The story of Kirkland Lake can be summarized briefly under three headings: (1) facts as to occurrences; (2) inferences as to structural origin; and (3) tentative economic conclusions.

1. *Facts as to Occurrences* — After eighteen years of development in the Kirkland area, the following facts as to occurrence stand out:

No ore is found, nor any "main break," east of Tough-Oakes, in spite of huge sums spent in development of the Continental mine and other holdings.

The number of veins is greatest at the Tough-Oakes mine, and the number decreases as one goes westward, until only one main vein with a few minor ones is found at Teck-Hughes and Kirkland Lake mines.

Rich ore on surface at Tough-Oakes compares favorably with rich ore found in Teck-Hughes and Lake Shore at depths of 1,500 ft. and more.

No real ore is found in Teck-Hughes above the 500-ft. level comparable in size and grade to that below the 1,000-ft. level. (See p. 31 of the 1920 Ontario Bureau of Mines Report and compare with recent annual reports of Teck-Hughes.)

No ore of consequence has been found below the 500-ft. level of Tough-Oakes. A longitudinal section by geologists of the Ontario Bureau of Mines in the 1920 report shows ore bottoming below the 400- and above the 500-ft. levels. Work in the years 1923 to 1928 has revealed small, patchy ore-shoots down to the 1,200-ft. level, but the fact that companies possessing them have gone into liquidation shows this work was not economical.

Deep development in the Wright-Hargreaves mine in 1928 was disappointing and resulted in new mine management. This work showed the main vein to have split into a number of smaller ones. Recent operations have revealed much ore, most of which is in the upper levels.

Ore at depth at the Kirkland Lake mine is more continuous and of better grade than in the upper levels. Ore has now been developed on the 4,750-ft. level.

2. *Inferences as to Structural Origin*

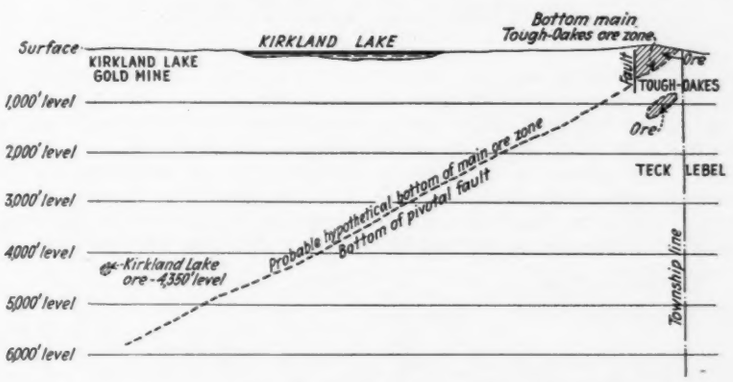

Fig. 2—Longitudinal section through ore zone, looking north. Kirkland Lake gold area, Ontario. Line showing is to be regarded as representing an idea, not a proved geological fact.

—Inferences deducible from the preceding facts are:

The "main break" of Kirkland Lake camp is a pivotal fault hinged at great depth to the west and dying out and coming to the surface at the Tough-Oakes. Structural geologists readily understand that the end of any fault is expressed by the tailing out of the main fracture into a number of smaller fractures, a feathering-out effect such as the Horse Tail fault at Butte, Mont.

Ore solutions arose from great depths from the west along this structural fault to the surface. This accounts for the fact of the occurrence of rich ore at surface at Tough-Oakes, with subsequent impoverishment in depth and lack of real ore in Teck-Hughes until below the 500-ft. level. This same idea of the pitching of Kirkland Lake ore to the west in depth was first brought out in public by Dr. J. B. Tyrrell, consulting geologist of Kirkland Lake Gold Mines about 1925.

The so-called pitch of Kirkland Lake ore to the west is thus determined by this pre-existing structural fault.

3. *Tentative Economic Conclusions*—The conclusions of this nature to be drawn from the foregoing are:

Continuance of values to great depth[1] is favored structurally in the mines at the west end of the camp.

[1]There is a modifying consideration of structure to the west—namely, occurrence of dark lamprophyre and thinning out of red intrusive syenite, which may control continuation of ore to great depth. Not enough data are available at present to render practicable a discussion of this point intelligently.

Ultimate depth of ore may be well over 5,000 ft. vertically, but such deep ore may be many thousand feet horizontally to the west of its surface outcrop. For instance, at the Homestake mine, South Dakota, ore in the Ellison shaft at a depth of 2,500 ft. is approximately a mile south along the strike of the surface outcrop.

Postulating indefinite lives in depth for mines in the central and east-central area of Kirkland Lake is unwise, unless deep development shows ore to be present. New developments in depth should be carefully watched in the ensuing years. At all times one must be prepared to modify one's stand according to the newest data that may be revealed by the latest adequate development.

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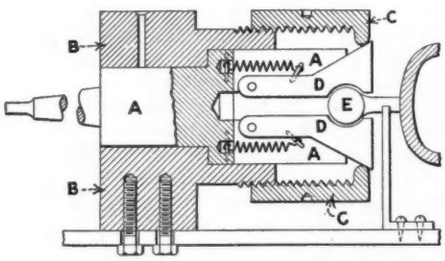
Remachining Radius Rod Balls on Ford Trucks



AN UNUSUAL DEVICE for remachining radius rod balls on Ford trucks is used in the shops of the Miami Copper Company, writes C. J. Naff, of Miami, Ariz. This part of the truck wears rapidly and must be readjusted periodically to prevent vibration and noise. The machine shown in the accompanying sketch is built on the principle of a self-adjusting drill chuck, and comprises a revolving part *A*, consisting of a Morse taper and three spring-controlled tool-steel cutters *D*; a stationary part *B*, bolted to a base plate designed to accommodate and automatically align the radius rod; a hardened telescopic cap *C*; and a light support to hold the neck of the radius rod ball *E*. The cutters *D* are controlled by cap *C*, which, when gradually removed from part *B*, presses the cutters against the worn ball *E*. The machine was built in the company's tool room, and is actuated either by compressed air or by an electric motor.

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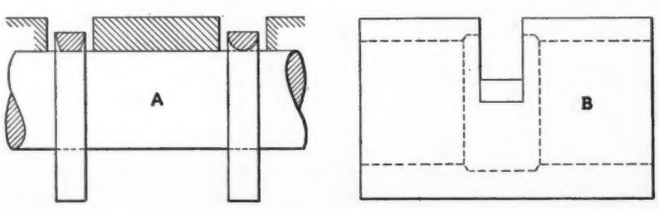
Improved Oil Rings

CORRECT bearing temperatures depend largely upon proper design of oil rings, according to Charles Labbe, of Death Valley Junction, Calif. The commonly used square or rectangular-shaped rings often cause trouble. While in motion each ring frequently comes in contact with the sides of the ring slot from being scraped off the sides. An additional improvement, shown in *B*, consists of a counterbored recess near the oil-ring slot, to provide storage for excess oil. This causes a film of oil to form on the shaft as soon as the machine is set in motion; and uniform distribution of oil with a minimum number of oil grooves is thus insured.



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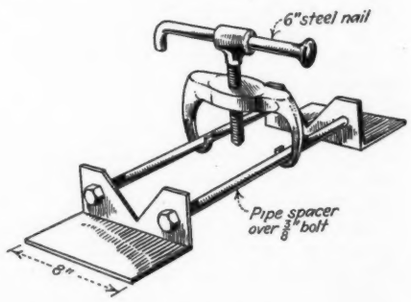
Home-made Vee Blocks

A SET of inexpensive vee blocks for holding round machine parts and others of different shape in the drill press has been developed by T. C. Hulton, master mechanic, Cia. Minera Chambas, Abras Grandes, Cuba. The device, shown in the accompanying sketch, is made entirely from waste material and consists of two vee-notched 2½-in. angle irons, spaced according to requirements by two ⅜-in. pipe spacers and two ⅜-in. bolts. A light jackscrew is used to hold the object rigidly to the blocks. The given dimensions may be changed to suit machine parts of any size.



New Quicksilver Discoveries

W. M. Weigel

Another source of domestic quicksilver has apparently been found. Until more detailed information concerning the deposit has been obtained, however, a reliable estimate of its economic importance is impossible. Nevertheless, the discovery already has several interesting features, one of which is the presence of native quicksilver—a rare occurrence that has aroused much speculation elsewhere, principally in Mexico, where "finds" of the metal in this form have been traced to losses from pack-train shipments.

DURING the summer of 1931 cinnabar was discovered in Southwestern Arkansas, adding another uncommon mineral to the many which have been found in this State. The two locations in which the discoveries were made, within a short time of each other, are in Pike County, one in the central part and the other about 16 miles away near the eastern border. This area is on the southern edge of the Ouachita Mountain region. The general geology of the district has been very fully covered by Purdue and Miser in U. S. Geological Survey Bulletin No. 808 (1929).

The rocks of the immediate locality consist entirely of Stanley shale with the geologically overlying Jackfork sandstone, both of Mississippian age. A narrow belt of the Atoka formation, of Pennsylvanian age, the remains of a synclinal fold, exists from one to two miles north of the general area in which the cinnabar has been found, and a wider parallel belt of the same formation is about two miles to the south. The structure is marked by intense folding, so that the surface outcrops and topography consist of alternating ridges of the more resistant Jackfork sandstone and valleys of the Stanley shale. The general strike of the formations is about north 75 deg. east, with a dip varying through all angles to the vertical. In some localities the beds have been overturned from ten to twenty degrees past the vertical. The Stanley has a thickness of about 6,000 ft. and the Jackfork from 5,000 to 6,600 ft., according to Purdue and Miser.

Fig. 1, taken in part from the geological map by Purdue and Miser, shows the general geology of the district. This has been extended a short distance on the east beyond the boundaries of the original map, to take in the location of the discoveries at the eastern end. The northern edge of the overlying Cretaceous formation is from three to seven miles south of the area where the cinnabar has been found. The map shows the location of the igneous rocks southeast of Murfreesboro, Ark., in which diamonds of good quality have been found. So far as known, this is the nearest occurrence of igneous rocks to the discoveries of cinnabar.

Owing to the rapidity with which different deposits have been discovered, some confusion has existed as to where and by whom the original discovery was made. On June 29, 1931, W. F. Hintze, a prospector at Murfreesboro, Ark., sent me for identification a small piece of sandstone carrying cinnabar. I did not at once notify Mr. Hintze that the mineral was cinnabar, thinking that he may have obtained it from some other part of the country on some of his prospecting trips, as its origin was not given. Mr. Hintze was asked for additional samples and the location. On July 7 he sent some additional samples and gave the approximate location, which was in the southern part of Sec. 1, T-7-S, R-26-W. On July 14 Mr. Hintze was notified that the mineral was cinnabar and the suggestion made that he do what he could to open up the discovery.

In May, 1930, D. F. Short, a section foreman on the Missouri Pacific R.R., at Amity, Ark., noticed a red mineral in some rock which was being blasted out for riprap. He did not at that time know what it was, but a piece of it was finally taken to Caddo Gap, a near-by town in an adjoining county, and placed with a collection of other minerals of the district. About July 20, 1931, Moritz Norden, of Hot Springs, Ark., noticed this mineral and identified it and had Mr. Short take him to the original point of discovery, which was in Sec. 28, T-6-S, R-23-W, in the eastern edge of Pike County, on Antoine Creek. Since then other deposits in both of these localities have been found. One intermediate discovery about halfway between the two ends of the area has also been made. These locations are indicated on the accompanying map.

The original discovery of cinnabar in Arkansas may antedate the present discovery by many years. I have had a report that the records at Mount Ida, the county seat of Montgomery County, lying just north of Pike County, contain the record of the filing on a cinnabar claim in southwestern Montgomery County about fifty years ago.

No attempt was made by the discoverers of the deposits to develop or exploit their discoveries until about the first of September of this year. Since that time prospecting has been quite active, and both Norden, in the eastern end of the district, and Leo Yount, Inc.,

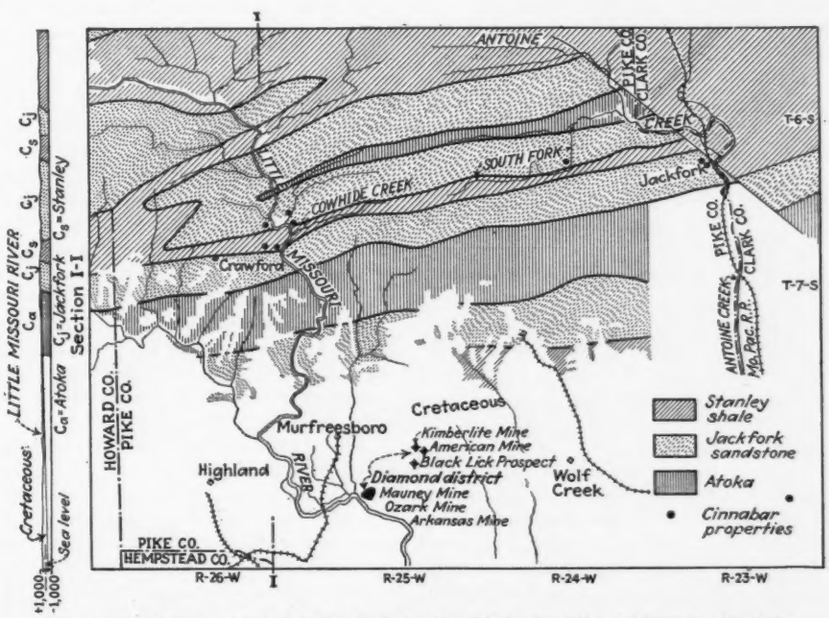


Fig. 1—Geological map of parts of Pike and Clark counties, Arkansas, showing cinnabar prospects. Adapted from U.S.G.S. Bull. 808, by A. H. Purdue and H. D. Miser.

Fig. 2—Outcrop of cinnabar

Fig. 3—Open cut on cinnabar prospect

and W. F. Hintze, in the western end, have had some men working, stripping the outcrops and attempting to determine the character of the ore and if the deposits are of economic value.

The discoveries of cinnabar so far made have been confined to the lower part of the Jackfork sandstone and have been found on the slope and near the top of the steep ridges formed by the Jackfork. Sufficient work has not yet been done to prove definitely the value of the deposits or to arrive at any fixed conclusions as to the type and continuity of the orebodies.

In both areas where discoveries have been made the Jackfork sandstone has been fractured and fissured by minor folds and faulting. In the eastern end is a pronounced regional fault near the discovery as indicated on the map. No main fault has so far been located definitely in the western end. However, the existence of a major fault in this locality is suspected, owing to the intense fracturing of the rock and other local disturbances, as the strike of the formations varies by as much as 90 deg. within short distances. If a fault exists, it is probable that it follows the general line of the Little Missouri River in this section.

The cinnabar occurs principally in the bedding planes, fractures, joints, and small fissures in the sandstone. At places, thin beds of shale are found interbedded with the sandstone, and cinnabar is sometimes found with this; but this is unusual. The mineral itself is well crystallized, although some of the fissures where weathering has taken place are filled with earthy, soft, or amorphous cinnabar. At one point near the original discovery in the western end a vein of almost pure cinnabar was followed for several feet. This varied from $\frac{1}{2}$ to $1\frac{1}{2}$ in. thick and gradually changed to a vein filling of white granular secondary quartz, containing segregations of pure crystalline cinnabar up to $\frac{1}{4}$ in. in diameter. There is no continuity to the veins either along the beds or joints, but the cinnabar may be continuous for from a few inches to several feet and then stop and possibly reoccur in an adjoining fissure. The sandstone itself is a fine-grained light gray to light buff rock cemented with secondary silica, and much of it is so firmly cemented as to be quartzitic. At some of the prospects the cinnabar is disseminated through beds of the sandstone. This is particularly noticeable on the prospects in Sec. 12, T-7-S, R-26-W, as shown on the map. Disseminations of considerable richness were noted at a distance of 5 or 6 in. from the nearest visible joint or fracture. Sufficient work has not yet been done to determine whether such disseminations follow any particular bed or have extensive continuity.

An occurrence of stibnite was reported with the cinnabar at one prospect in the western end. This is of possible interest, as stibnite has been produced commercially along the regional strike about 35 miles to the west. Native quicksilver was found on the prospect in Sec. 1, T-7-S, R-26-W, occurring in small cavities in the sandstone originally filled with cinnabar.

In the eastern end of the district in Sec. 28, on the southwest slope of a ridge, a prospect has been uncovered showing a mineralized width of about 5 ft. This is about 150 ft. above the valley and about halfway between the valley and the top of the ridge. The strike of the formation at this point is approximately north 35 deg. east, with a dip nearly vertical. This face is shown in Fig. 2, which illustrates the fractured character of the rock. On the opposite slope of this ridge at a horizontal distance of about 300 yd., and in the direction of the strike, two other prospects have been uncovered. The formation at this point has a strike of about north 50 deg. east. An open cut has been driven into the hillside about 25 ft., exposing a vertical height of about 14 ft. The face of this cut shows a mineralized width of about 3 ft. About 50 ft. southeast of this another open cut has been started, showing a mineralized width of 5 to 6 ft. The dip at these locations is practically vertical. They are at an elevation of about 250 ft. above Antoine Creek in the valley to the east.

Other prospects have been reported in this area, but no work has yet been done to uncover them. A discovery has been reported in the southeast quarter of Sec. 27, T-6-S, R-24-W (Fig. 1).

At the time of writing, Oct. 15, more work has been done on the west end. In the southwest quarter of Sec. 6, T-7-S, R-25-W, a prospect has been uncovered reported to be of lower grade, but more uniform and extending over a greater width.

The most extensive work so far done has been in the southwest quarter of Sec. 1, near the original discovery. Here the side of the ridge has been stripped for a distance of probably 100 yd. in an attempt to determine the trend of the ore, but so far without much success. At the western end of the prospect an open cut has been excavated, showing ore over a width of 6 to 8 ft. Here the thickest vein of pure cinnabar was uncovered. The sandstone at this point has been so distorted and fractured that it is difficult to distinguish between joints and bedding planes. The general strike is about north 70 deg. east, but the strike varies by as much as 30 deg. within short distances. About 100 yd. east of this western opening another open cut has been made near the top of the hill, showing cinnabar. Lenses of interbedded shale have been exposed here. Leo Yount, Inc., which controls this property, is at the time of writing installing a small distillation plant of about 10 tons' daily capacity, and expects to have it in operation within 30 days.

Two prospects are being developed in the south half of Sec. 12, T-7-S, R-26-W. More work has been done on the eastern one of these. An open cut or trench at this point is about 15 ft. long and 5 ft. deep, showing from 2 to 5 ft. of ore-bearing sandstone. This particular location is interesting from the fact that the strike of the sandstone at this point is north 12 deg. west, or almost at right angles to the general strike of the district. About 300 ft. north of the prospect the strike swings around to the northeast, and about 150 ft. south of the prospect the strike abruptly changes to south 75 deg. east, so that this prospect is on the outer edge of a bend or horseshoe-shaped curve in the structure. This location is near the top of a narrow ridge the backbone of which is formed by an unusually resistant bed of sandstone from 36 to 40 in. thick, dipping about 80 deg. to the southwest. The cinnabar occurs in the beds close to and against this particular bed, but does not seem to penetrate it. This bed of sandstone projects considerably above the rocks on each side. At places farther down the point of the ridge, where it swings to the east, the sandstone stands above the surface to a height of 10 to 25 ft. Fig. 3 shows the open cut being made at this prospect just to the west of and against this resistant bed. As mentioned before, this location is distinguished by disseminated cinnabar in the apparently solid beds of sandstone, in addition to that found in the joints and bedding planes. The particular beds in which this occurs have a glassy translucent appearance on a fresh fracture, whereas the thick upstanding bed adjacent is tough, fine-grained, and opaque.

The distortion of the rocks at this prospect and at the prospect in Sec. 1, one mile north, indicates a considerable zone of fracturing caused by local flexure or faulting in this area, with a strike approximately parallel to that of the fault which has been fairly well worked out in the eastern end of the district, and following the valley of the Little Missouri River. Much work must be done to work out the local geological problems in this area.

The prospects in Sec. 12 seem, referring to the map, to be located in the Stanley shale. This, however, is not the fact, and because the topography of the country is broken, investigations have not yet definitely determined whether or not Stanley shale exists between the discoveries in Sec. 1 and Sec. 12.

I hesitate to make any estimate of the cinnabar content of a workable thickness of ore at any of the prospects. Owing to the erratic character of the occurrences, to make an accurate sampling on any face is practically impossible, as the mineralization varies so rapidly in all directions. To form a definite opinion as to the value of the deposits, the results from the operation of a small distillation plant will be necessary. It is possible to pick out specimens of ore or pieces of ore weighing several pounds, which would contain from 10 to 30 per cent mercury. Much of the ore would undoubtedly run in excess of 1 per cent, but to predict at this time how much barren rock would have to be removed to secure ore of this grade is not possible. The development so far done, however, looks encouraging, as in all exploration a greater mineralized width has been exposed than was indicated on the surface.

Dr. George C. Branner, State Geologist of Arkansas, published a preliminary report on the discovery in the *Arkansas Gazette* of Aug. 30, 1931. This is to be followed by a more complete report as development of the deposits progresses.

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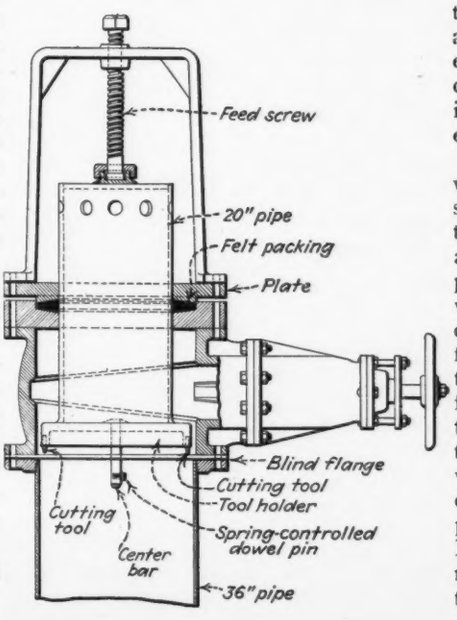
Novel Pipe Repair

AN UNUSUAL PIECE of repair work, cutting out a blind flange on a 36-in. pipe main, under 4-lb. pressure, and addition of a branch line, was recently performed by F. J. Martin, master mechanic at Miami Copper, Miami, Ariz. The problem was a difficult one, as the line supplied air to the flotation department and a shutdown of the mill was out of the question. Also, the work had to be performed without interruption in operation and without serious loss of air. The task was performed successfully by the method described in the following and illustrated in the accompanying sketch. A home-made cutting device, operating in an air-tight chamber was used to cut the flange as rapidly as possible, with a minimum loss of air. It consists of the cutter proper, equipped with a welded-on toolholder, and a guide, or center bar, fitted with a spring-controlled dowel pin; two end plates, with felt packing, shaped like stuffing boxes and bolted to the flange end of the gate valve; and a support made of 1x2-in. bar iron, equipped with a feed screw. The cutter part is actuated by a steel rod inserted into the holes at the feed-screw end.



In cutting out the flange, the first step was to drill a hole, corresponding in size to the diameter of the center bar, in the center of the blind flange, immediately inserting the guide bar of the cutter proper. The end plates and the support with its feed screw attached to the cutter end were then bolted to the open flange of the valve, and the cutting tools advanced to the flange face and fed intermittently while the cutter was turned slowly with a steel rod. When the flange was cut through, the cutter, with the cut-out disk fastened to the center bar with the protruding dowel pin, was brought back to the end plates. Finally, the assembled device was removed and the pipe extension bolted to the free valve flange.

SUSPENSION BIN CHART

Designed and Copyrighted by

Sydney C. Mifflen

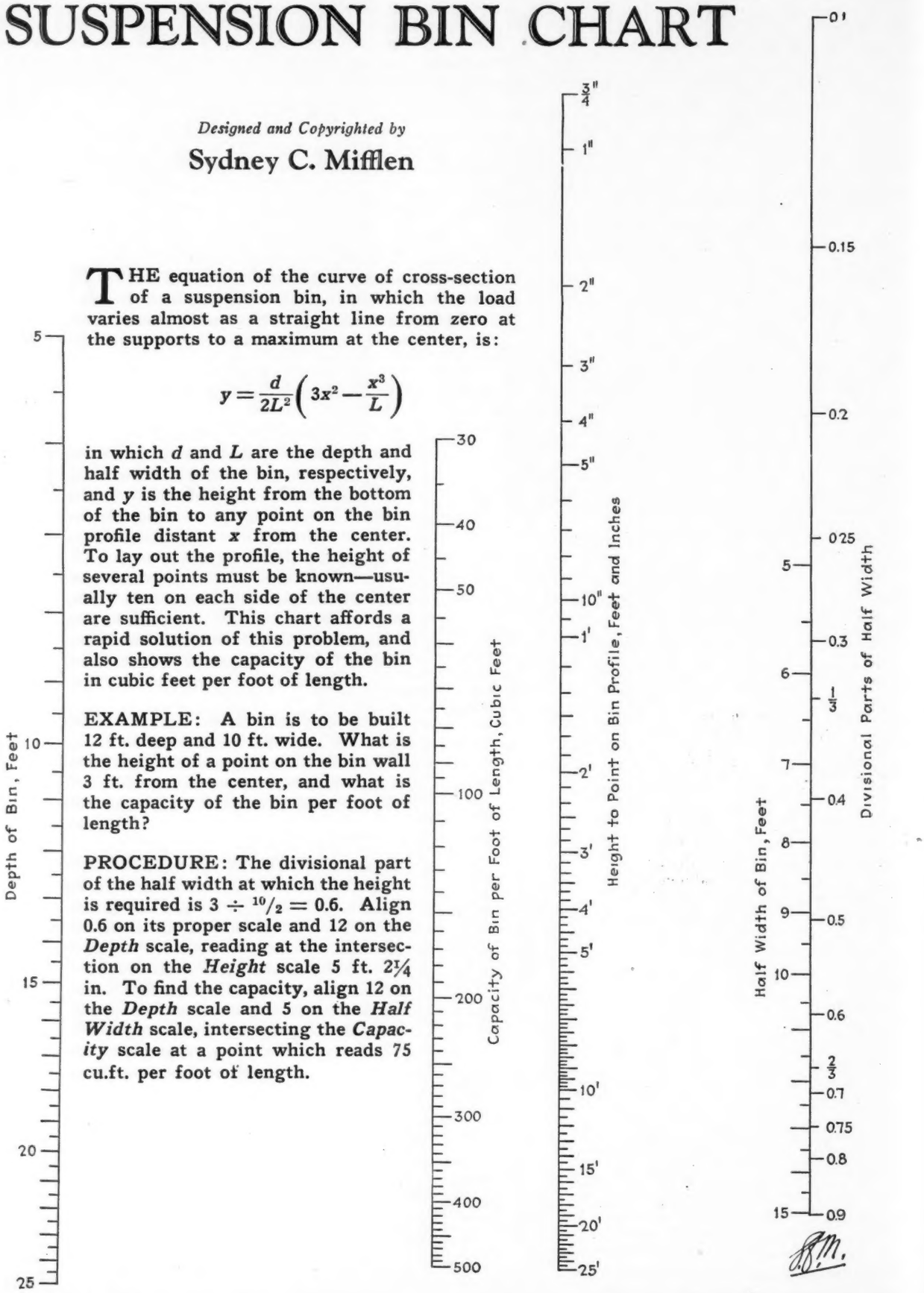
THE equation of the curve of cross-section of a suspension bin, in which the load varies almost as a straight line from zero at the supports to a maximum at the center, is:

$$y = \frac{d}{2L^2}\left(3x^2 - \frac{x^3}{L}\right)$$

in which d and L are the depth and half width of the bin, respectively, and y is the height from the bottom of the bin to any point on the bin profile distant x from the center. To lay out the profile, the height of several points must be known—usually ten on each side of the center are sufficient. This chart affords a rapid solution of this problem, and also shows the capacity of the bin in cubic feet per foot of length.

EXAMPLE: A bin is to be built 12 ft. deep and 10 ft. wide. What is the height of a point on the bin wall 3 ft. from the center, and what is the capacity of the bin per foot of length?

PROCEDURE: The divisional part of the half width at which the height is required is $3 \div {}^{10}/_{2} = 0.6$. Align 0.6 on its proper scale and 12 on the *Depth* scale, reading at the intersection on the *Height* scale 5 ft. 2¼ in. To find the capacity, align 12 on the *Depth* scale and 5 on the *Half Width* scale, intersecting the *Capacity* scale at a point which reads 75 cu.ft. per foot of length.



Personal Notes . . . Comment . . . Criticism

George L. Barnett is superintendent of Treadwell Yukon operations at Tybo, Nev., not at Bodie, Calif., as was stated on page 376 of *E.&M.J.* of Oct. 26. R. L. Duncan is superintendent at Bodie.

Harvey S. Mudd, mining engineer of Pasadena, Calif., has been appointed a member of the Engineering Board of Review of the Metropolitan Water District of Southern California.

L. L. Jessen, a partner in the Boyle Brothers' Drilling Company at Salt Lake City and Vancouver, B. C., has been appointed Royal Danish Consul for British Columbia and the Yukon.

E. E. Whitely, formerly assistant manager of Calumet & Arizona Mining, has left Bisbee, Ariz., and he and his family are making their home in Pasadena, Calif.

Edward H. Robie, who recently resigned as associate editor of this publication to accept the assistant secretaryship of the A.I.M.E., effective Jan. 1, 1932, studied at Cornell and Michigan universities, being graduated from the latter in 1911. Specializing in smelting practice, he was associated with the Canadian Copper and International Nickel companies during 1913-18, in various positions leading up to and including that of assistant metallurgist, during which time he made an intensive study of milling and smelting practice in Canada and the United States. He joined the staff of *Engineering and Mining Journal* in 1919 as assistant editor, being appointed associate editor in 1927. In recent years he has been closely identified with Institute activities in the metropolitan area, having been treasurer of the New York section for the last two years. Also, he is a member of the Canadian Institute of Mining and Metallurgy. He has earned the high regard and esteem of all with whom he has been associated, and he will undertake his new duties in January with the best wishes of his colleagues on the staff of this publication.

E. J. Carlyle, recently elected secretary-treasurer of the Canadian Institute of Mining and Metallurgy, was born in Woodstock, Ont., in 1877. After preparatory schooling in Woodstock, he entered the Arts Course at McGill in 1898, transferred to the Faculty of Applied Science in 1900, and graduated in mining in the spring of 1904. Training in metallurgy followed at Anaconda, Mont., and later in Arizona. In 1907 he went to Russia and spent four years in the Urals with the Kyshtim Corporation. In 1912 he made an inspection of the smelters at Rio Tinto, in Spain, and then spent more than a year in Argentina. Returning to Russia in 1914 he was for three years metallurgical engineer for the Sissert Company, engaged in the development of copper mines adjoining the Kyshtim property. Conditions during the Kerensky régime made further production impossible, and the company, still hoping to proceed with the development of the property, sent him to America to continue there the designing of a new smelter and refinery. Nationalization of the property by the Soviet government terminated the activities of Sissert Corporation in 1918. Returning to Canada, Mr. Carlyle was retained as smelter superintendent by the British American Nickel Corporation at Sudbury, Ont. Varied professional work followed, and from 1926 until October, 1931, he was superintendent of the Shorey Plant of American Smelting & Refining Company in Peru. Here, too, he passed through a period of revolution, and Peru, in common with her sister republics, had to deal with acute political and labor unrest. In September last, Mr. Carlyle returned to North America. *Engineering and Mining World* extends to Mr. Carlyle its congratulations and cordial wishes for success in the discharge of his new responsibilities.

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Obituary

John Sheldon, metallurgical accountant for the Phelps Dodge Corporation, at Clifton, Ariz., died suddenly on Nov. 28, following a heart attack. He was 56 years old.

W. D. Callender, publisher of *Rock Products,* died on Nov. 9 in Chicago. He was 60 years of age. Mr. Callender was associated early in his career with John A. Hill, as advertising manager of *Engineering and Mining Journal,* for several years.

Louis Kaufman, pioneer Butte merchant and mining man, president of the Butte Machinery Company, died in Butte on Nov. 17, after a long illness. He was born in Germany in 1865 and came to Butte in 1889, where he had since made his home.

Edmund F. B. Doude, 59, consulting engineer and research chemist, was buried in the Salt Lake Memorial mausoleum Friday, Nov. 20. Born in New York, July 2, 1872, Mr. Doude studied in the United States and in Europe. He was a member of the American Society for Testing Materials, the Chemical Society of Japan, the Chemists, Mining and Metal Societies of South Africa, and the Royal Society of Arts of England.

Russell G. Wayland

With deep regret is announced the sudden death, of heart disease, on Nov. 27, of one of the leading contributors to the recent Homestake issue of this publication —Russell G. Wayland. Educated at the University of Washington, Mr. Wayland became associated with and, finally, general superintendent of the Alaska Treadwell Company, 1916-18. After War service he joined the Homestake Mining Company as chief engineer and assistant general manager, a position held until his untimely decease, which deprives the company of a capable technical executive, and a wide circle of friends and colleagues of one who was held in deep affection and high esteem.

Among contributors to this issue:

Ira B. Joralemon, a graduate of Harvard University, at various times has been associated with Calumet & Arizona, as assistant engineer and geologist, chief geologist, or assistant general manager. Journeys of technical observation for the Anaconda company took him to South America (1914-16) and to Russia and Siberia (1917). He served in the War as captain and major in the United States Air Service, and is a Chevalier of the Legion of Honor.

I. S. Heller, author of the article "Automatic Pulp Sampling and Distribution," is a member of the engineering department of The New Jersey Zinc Company. He has been engaged on technical investigations with the company for more than twenty years.

Robert D. Hoffman, consulting geologist, with headquarters in New York, received his education at Harvard University. Although professional work has taken him to many parts of the United States and Africa, Canada has always been and still remains his chief interest. He spent several years at Kirkland Lake, when it was still a little-known gold camp somewhere southeast of Porcupine; was a pioneer in the development of the Rouyn district; and he played a part in the early history of the Sherritt Gordon mine, in northern Manitoba.

W. M. Weigel (Missouri School of Mines) gained preliminary experience with various lead companies in Missouri before being appointed associate professor of mining and ore dressing at the Pennsylvania State College (1908-12). Followed professional work in Canada until 1915, when he resumed his former position on the faculty of the Pennsylvania State College. After mining, concentration, and smelting work in Canada and Missouri (1917-21) he was appointed mineral technologist for the U. S. Bureau of Mines, from which he resigned, in 1926, to take his present position as mineral technologist for the Missouri Pacific Railroad.

Facts vs. Fiction About Great Bear Lake

To the Editor:

An editorial in the Nov. 23 issue of *Engineering and Mining Journal,* based on an unauthorized and rather absurd newspaper story, casts discredit, by inference at least, on the published statements of qualified authorities, including those of the Dominion of Canada, Department of Mines.

The Aug. 20 issue of *The Northern Miner* printed a report by Norman C. Pearce, one of the editors, headed "Successor to Famous Cobalt Found at Great Bear Lake." On Oct. 8 the preliminary statement, by Hugh S. Spence, Department of Mines, Ottawa, confirming reports of important mineral discoveries in the Great Bear Lake region, was given wide publicity in the Canadian press. On Oct. 17 the Department of Interior, Ottawa, Canada, issued a letter entitled "Valuable Sources of Radium in Northern Canada—Pitchblende Deposits Show Great Length and Findings of Rich Silver Ore Reported by Government Technologists." The November issue of *Industrial and Engineering Chemistry* stated, that, "According to the reports by Hugh S. Spence, Department of Mines, Ottawa, there have been found at La Bine Point in the Great Bear Lake region very important deposits of pitchblende occurring in several extensive veins." The report referred to, in my opinion, is one of the most significant statements ever issued under the authority of the Canadian Department of Mines.

In describing the pitchblende deposits which constituted the first discoveries in the new camp, Mr. Spence says that "There is, in short, every evidence that there exists at La Bine Point an extensive and fairly closely spaced, pitchblende vein system that can readily be exploited by underground developments." Mr. Spence adds that No. 2 vein has been followed for 1,400 ft., where it passes into a small lake, and fourteen surface pits have been opened on it at intervals. Pitchblende was encountered in thirteen of the pits in the form of a strong lead, and can be picked out from the surface outcrop for 800 ft. . . . The veins usually consist of either massive pitchblende from ½ to 6 in. wide or of several thinner, ¼- to 1-in. stringers, separated by similar widths of quartz or calcite gangue. The pitchblende can easily be separated by hand cobbing; a shipping product of 50 per cent or better uranium oxide should be obtainable without difficulty by such means . . . I broke heavy uranium stain and pitchblende from a fourth, unexplored vein, lying about a mile beyond No. 3.

Since this report was made, a new find of massive pitchblende containing a high content of native silver has been reported about ten miles to the southeast of La Bine Point, as well as other finds, which bear out Mr. Spence's predictions and indicate a widespread area of mineralization, not only north but south of La Bine Point deposits. Mr. Spence says:

"The silver occurs in the native form, as wire or leaf. Probably the most important occurrence to date is that on the easterly 200-ft. section of the No. 2 pitchblende vein on La Bine Point . . . It (silver) occurs as (1) leaves and films throughout the massive pitchblende; (2) a strong vein, up to 30 in. wide, of carbonates and wire silver, in contact with the pitchblende (silver constituting often about 40 to 50 per cent of the vein matter); (3) leaves and films on joints and cracks in a 10- to 15-ft. sheared band on the footwall side of the vein. On several of the Bonanza claims six miles south of La Bine Point, the silver occurs as leaf and wire in the calcite filling of joints in narrow, sheared greenstone bands, as well as in the sheared rock itself. Some of the surface ore found here is very rich. A block of 40 lb. in large part silver, was shipped out in July. On another of the Bonanza claims, the silver occurs as wire, thickly distributed through a 26-ft. band of sheared and highly altered rock."

At a meeting of the Canadian Institute of Mining and Metallurgy, Mr. Spence supplemented his report by presenting preliminary assay results on samples of pitchblende and silver ores from No. 1 and No. 2 veins of the Eldorado Company at La Bine Point. These samples, Mr. Spence stated, showed uranium oxide content of from 30 to 62 per cent—at $50,000 per gram, a radium content of from $4,000 to $8,000 per ton of ore. Samples of silver ore associated with the pitchblende ran from 1,634 to 8,965 oz. silver per ton.

Referring to the recent discovery of pitchblende and high-grade silver at East Bay, ten miles to the southeast of La Bine Point and about six miles east of the Eldorado Bonanza vein, Mr. John E. Hammell, president of Northern Aerial Minerals Exploration, recently stated that "Silver values up to what we used to consider high-grade in the old Cobalt days, and radium, have been found in the vein," adding that "The Great Bear Lake discoveries are far more important than the public seems to realize."

I have made a careful study of all available information regarding the new district, including the reports of my own representatives at Great Bear Lake, but have hitherto made no statements for publication, nor have I authorized the use of my name in connection with any publicity regarding this new camp.

E. E. CAMPBELL.

New York, N. Y.

[*Engineering and Mining Journal,* although more than willing to give space to Mr. Campbell's courteous comments, demurs at the assertion that the editorial in question cast discredit on any authority. Several accounts of the occurrences at Great Bear Lake have been published in this periodical, but a consensus of opinion prevailed that progress in Canada would not be helped by a newspaper story in which fantastic claims were attributed to a well-known mining engineer. Had a disavowal of the alleged interview appeared in the newspaper in which it was featured, *Engineering and Mining Journal*—and, doubtless, our esteemed Canadian contemporary *The Northern Miner*—would have refrained from satirical comment.—*The Editor.*]

■

Louis D. Huntoon, consulting engineer, of New York City, in a recent letter to *The Northern Miner,* points out that because statisticians must of necessity use yardsticks and are not acquainted with the possibilities of individual mines, they have been unable to forecast gold production correctly. In May, 1930, he submitted an estimate of Canadian gold production in 1930 and 1931 to George Roberts, a member of the Gold Delegation of the League of Nations. This estimate, although it was $9,000,000 higher than that of the Dominion statistician, has since proved conservative. Mr. Huntoon put 1931 gold output in Canada at $50,000,000, whereas it will probably reach $55,000,000.

Announcement

RAPIDLY CHANGING economic and industrial conditions necessitate frequent readjustment of objectives and policy, especially in regard to the need for concentration and coordination of effort. Establishment of *Engineering and Mining World* in 1930, to circulate only in countries foreign to the United States—an extension of the 64 years' service of *Engineering and Mining Journal* to the metal and non-metallic mineral industries—permitted a broadened scope of editorial coverage, geographical as well as technical, resulting in contacts with every important mining region in all five continents. Experience gained in the intervening two years has demonstrated an international interdependence in respect to technical knowledge, as well as in regard to the broader policies of economic control and adjustment of production. Reader requests and demands have shown a striking uniformity, whether emanating from Europe, Asia, Africa, or the Americas. The logical sequel to this progressive step in technical journalism is therefore the amalgamation of *Engineering and Mining World* with the parent publication, *Engineering and Mining Journal,* which amalgamation will go into effect in January, 1932, the consolidated magazine, to be issued at monthly intervals, carrying the original title—"*Engineering and Mining Journal,* with which is consolidated *Engineering and Mining World.*" For those who require more frequent information on quotations, sales trends and news, *Metal and Mineral Markets,* published every week, is available.

The format and technical quality of the contents of *Engineering and Mining Journal* have met with so widely favorable a response from the field that ample justification exists for continuing the policies that have been responsible for its growth and influence. The editorial staff of the consolidated publication acknowledges and appreciates the support of an immense family of readers, and looks with confidence to them and to new and old contributors for a continuance of the encouragement and cooperation that have helped to build a service so acceptable to the profession and industry of mining.

INDUSTRIAL PROGRESS

Reducing Diamond-Drilling Costs

Two Interesting Developments

"Round shoulder" diamond drill bit set with small bort

During the past year or two, many companies and drilling contractors have experimented with the use of small African bort with most interesting results as to progress and reduced cost. Bits set with these small bort have been found to drill successfully in most formations in which the more expensive carbon or black diamonds have hitherto been used. The Sullivan Machinery Company, core drill contractors and manufacturers of diamond drills, has recently instituted a service in connection with the use of such bort, whereby so-called "Readyset" bort bits are now obtainable complete and ready for use. These are available in all standard sizes from "EX," removing $\frac{15}{16}$-in. core, to "NX," removing 2-in. core.

Thus it is now possible for a mining company that does its own diamond drilling to take advantage of the economies of small bort for prospect drilling work without the necssity of maintaining a diamond setter on the job. When a bit is worn out or requires resetting, all that is necessary is to remove the bort from the bits and return them to the company for credit, receiving immediately a complete new "Readyset" bit so that the work is not delayed.

A second development of great interest to diamond drill users is the use of "round-shoulder" bits. This development has been made possible by the adoption of the small bort already referred to. By rounding off the outside shoulder or cutting edge of the bit, approximately 40 per cent more bort can be set than in the old standard type of square-shoulder bits. The result of this is that the amount of work done in drilling is equalized between the outside and inside stones. This secures two results—namely a large increase in drilling speed, and reduction in the cost of bort wear or loss per foot of hole.

Records kept of approximately 15,000 ft. of diamond drilling in a formation consisting largely of solid trap rock, showed that with round-shoulder bits an increase of approximately 40 per cent drilling progress was secured, and the reduction in cost per foot for the cutting medium amounted to nearly 60 per cent.

With regard to the formations in which the small bort can be used satisfactorily, one may say they will secure the results indicated in any ordinary solid formation. In broken or highly fractured formation, the metal is worn away rapidly from the tiny stones which run from three to six to the carat. The same is true in highly abrasive or granular material. The same care should be exercised in running bort bits as in handling carbon bits. For example, they are not intended for drilling through loose gravel or surface overburden.

■

Those mining and quarrying companies that customarily set their own bits for diamond drilling will be interested in the accompanying article by a member of the editorial staff, describing the work of setting a bit with small bort, such as those referred to in the preceding paragraphs.

■ ■ ■

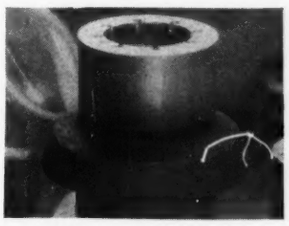
Setting Small, Uniformly Sized Bort in Core Drill Bits

George J. Young

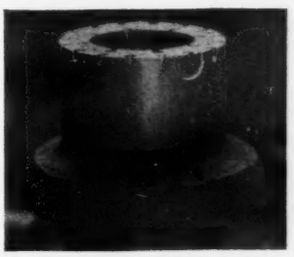
Bits in which stones have been set. On the right bit, inside and outside stones have been set. The left bit has been finished.

Recently, through the courtesy of the Mitchell Diamond Drill Company, in San Francisco, I was able to visit the diamond-setting shop and to see J. J. Coen and John Bergland at work setting "Finehards," as one dealer has named his line of small uniformly-sized African bort. Both were kind enough to give the following details of this interesting process.

The setting of these stones in the bit is similar in principle to the setting of black diamonds, with the exception that a greater number of stones are required and owing to the smaller sizes of the stones, more skill is perhaps required in the work. An ES bit, $\frac{13}{16}$ in. in core, requires 40 stones. These stones are set in three rows in the soft steel blank;



A blank bit with the inner holes drilled and broached, as described by George J. Young



A blank bit with inner and outer holes drilled and broached. Peening limits have been marked on one of the holes.

Fig. 1 — Holes drilled and slotted to the outside. Peening limits are established by the chisel marks on the crown and outer surface of the blank bit.

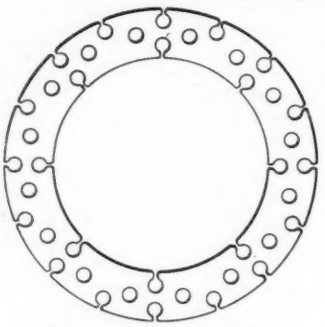


Fig. 2—Positions of the three rows of stones set in an ES bit.

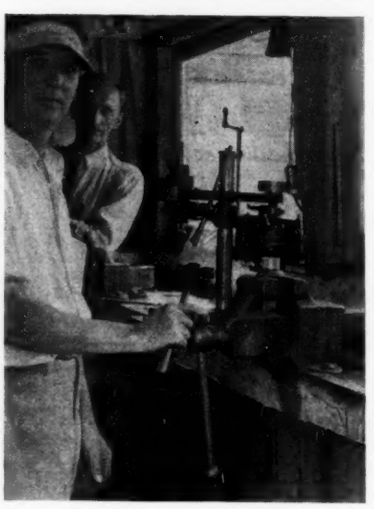
Fig. 3—Section of bit showing position of stones

an outer row of 16 stones, an inner row of 8 stones and a middle row of 16 track stones. Inside stones are set to give a clearance of 1/128 in. and the track stones project above the metal. It is necessary to so set the stones that all will meet the clearance requirements. One stone up and the other down represents faulty setting. Gage rings are used to control inside and outside clearances, and the proof of accurate setting with respect to projection above the crown of the bit is the fact that a flat surface such as the crown of a blank bit will rest upon the tops of the projecting diamonds without perceptible movement and with a glimmer of light between the two crowns when subjected to moderate pressure. Obviously, this requirement of uniform clearance and projection entails delicacy and skill in setting. It is for this reason that diamond setting requires exceptional mechanical skill, craftsmanship, keen eyesight, and an unusual touch sense. It is an art that few mechanics possess. Upon its accuracy depends the success of the bit when used. Experienced diamond drill contractors are therefore alive to the necessity of finding and employing the talent that can turn out diamond drill bits that will yield satisfactory service.

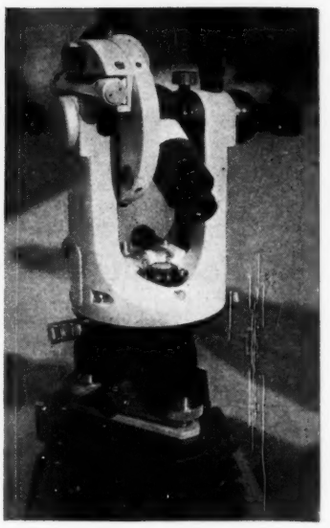
The various steps in the setting of a drill bit with these bort are as follows: The crown of the blank bit is divided by means of a set of fine-pointed calipers into eight parts, starting at a given punch mark placed near the inner edge of the crown. Each space is subdivided again. Punch marks are made, establishing the inner and outer rows. Holes for the inner circle of stones are next drilled, using a 7/64-in. drill and drilling to a depth of about $\frac{3}{64}$ in. Some of the holes are drilled normal to the crown and some at slight angles. Inside and outside holes are then slit with a chisel, opening them out as a narrow slot on inside and outside surfaces of the bit, respectively. Burrs are filed off and the crown and sides of the bit smoothed. The sides and top about each hole are marked as indicated in Fig. 1. Then the stones are selected and each stone is studied so as to determine its best position. The corresponding hole is then cut to receive its stone, the stone placed in position, and the soft steel surrounding it is worked gradually from all directions until the stone is firmly held in place. The peening area is limited by the chisel marks indicated in Fig. 1. Successively, the eight inside and the sixteen outside stones are set in this manner and the center row of sixteen stones is punch-marked and drilled. These holes are then cut out as may be necessary, the stones are set and the metal worked up to them.

Finehards, four to five to the carat, are selected for inside and outside stones. These are approximately $\frac{7}{64}$ in. in diameter. The first eight outside stones, set midway in the angles established by the inside stones, are of the best grade and of the same size as the inside stones. The second series of eight outside stones are somewhat smaller, 6 to 7 the carat, and are placed directly in front of the inside stones. A $\frac{3}{32}$-in. bit is used to drill this series of holes. The track stones, also 6 to 7 to the carat, are then set. The position of the various stones is indicated in Fig. 2.

No copper is used except in the setting of a very irregular stone, when a small-diameter copper wire is used to make a wedge which is driven into the open space. The practice is to set the stone in steel and to avoid all supplementary filling material. Inside clearance is 1/128 in., outside clearance 1/64 in. and top projection 1/64 in.



Interior of shop showing bench tools. J. J. Coen is on the left and John Bergland on the right.



Houghton gets this new theodolite

Stones are more or less pear-shaped and are set so that the bulk of the stone is on a diagonal with the direction of rotation. As noted in the foregoing, some of the holes in the crown are drilled at an angle to the normal and are pointed away from the direction of rotation. The purpose of this is to set the important axis of the stone in the line of the resultant. This gives the maximum strength to the setting. Clearance and projection are controlled so that the stones will take an equal burden of work. The stone with maximum clearance or projection will take the principal burden until it has been worn down to the clearances of its neighbors. It is therefore necessary to bring all of the stones to the clearance requirements.

The tools of the diamond setter consist of a heavy vise, a holder for the blank bit, an electrically operated sensitive drill upon an adjustable vertical standard, and a miscellaneous lot of small hand tools. Each diamond setter perfects his own tools, and, so far as I am aware, no attempt has been made to standardize the small tools. Magnifying glasses and a "holder" are used in studying the shape of the diamond.

The Latest in Transits

The cut above shows a Zeiss theodolite, Type 3, representing the latest development in transit design, which has been purchased by the civil and mining engineering department of the Michigan College of Mining and Technology, at Houghton. The instrument, said to be the second of its kind sold in the United States and the first to an American engineering college, differs in several important respects from previous instruments. The culmination of several decades of intensive study by its designers, Carl Zeiss & Company, and its Jena manufacturers, the theodolite is noteworthy for its precision, small size, and compactness of design. Total weight of the new instrument, includ-

ing tripod, allidade, and tribach, is only 33½ lb. The tribach is the unit corresponding to the crosshead on the American type and is used only on instruments with three leveling screws. In it is mounted a small complete telescope for centering without the use of a plumb bob.

The instrument contains no crosshairs. Instead, the lenses are etched with double vertical parallel lines. The underlying principle of their use is that more accuracy can be obtained by centering an object between two lines than by splitting the object with one line.

Two New Slusher Hoists

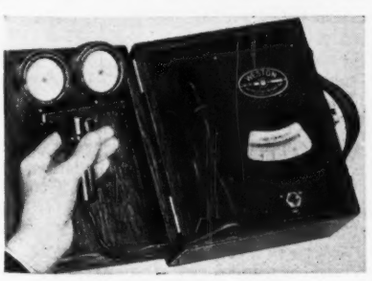
Two new sizes of electric double-drum hoists for scraping service have been introduced by Ingersoll-Rand. They are the No. 207, of 7½ hp., and No. 210, of 10 hp. These machines are constructed essentially the same as the 15-hp. and 20-hp. sizes, which have been made for some time.

For Better Lighting

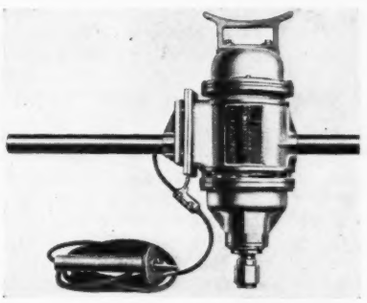
Adequate lighting in a plant often makes for increased efficiency and safety. An instrument for conducting accurate lighting surveys and which, it is said, can be used with ease even by a layman, has been developed by the Weston Electrical Instrument Corporation, of Newark, N. J. It is known as Model 603 Illuminometer. It consists of an indicating instrument and a light target assembled in a portable case. The target is on the end of a flexible cord, so that it may readily be placed in any position. This target or searching unit has two photo-electric cell units which convert light energy directly into electrical energy without the use of batteries or other auxiliary voltage. These units are of the "Photronic" type, recently developed by the company. They maintain constant output over long periods of time, and there is no dark current. The output from them is considerable, allowing the use of a strong portable instrument calibrated directly in foot-candles. The instrument has three ranges—10, 50, and 250 foot-candles.

Noranda's New Hoist

A new hoist having double drums of rolled steel plate 10 ft. in diameter and 72 in. face, is to be supplied to Noranda Mines, Ltd., Noranda, Quebec, by the Nordberg Manufacturing Company, Milwaukee, Wis. A departure from the manufacturing company's usual procedure is that this hoist, instead of being built at the company's Milwaukee plant, will be built by John Bertram & Sons Company, Ltd., Dundas, Ontario. The design will be Nordberg throughout. The hoist will have a 1½-in. rope sufficient for working to 4,200 ft. Rope speed is 2,200 ft. per minute and total rope pull 39,600 lb. At each trip a load of 12,000 lb. of ore will be raised in the 10,000-lb. skip. The hoist will be driven by a 1,550-hp. d.c. motor running at 68 r.p.m.



Facilitates lighting surveys



A new electric drill

Electric Drill Design Improved

Although the gas-proof electric drill here described is intended by the Ohio Brass Company, its manufacturer, for the coal industry, many operators of metal and non-metallic properties, especially those producing rock salt; or any working places where the ground is sufficiently soft and emanations of methane or marsh gas have been known to occur, will be interested in noting this latest type of electric-driven drill. The machine weighs but 62 lb. and is rated at 5 hp. for 20 min. This power is enough to twist off an auger, and naturally eliminates the possibility of delay due to the bit's being jammed while running. The handles and breast plates are completely insulated to provide extra protection against the possibility of a grounded circuit. The switch is in the end of one of the Bakelite handles. It is a 20-amp. quickbreak standard design, which may be easily renewed. The bearings are of S.K.F. annular and Timken-roller types. All gears are of heat-treated alloy steel, and all parts are made of light-weight metals wherever possible. The motor is fan-cooled. The cable is attached as an integral part of the drill. The drill has been approved by the Bureau of Mines for gassy conditions at 250 volts on 500-volt systems.

Magnetometer Improved

To free magnetometer work from the handicap of temperature effects in magnetometer field readings, which has hitherto made very accurate field work practically impossible, the American Askania Corporation, Houston, Texas, has recently undertaken a closer study of compensating magnetic systems for temperature. They found that by selecting material and design properly, considerable improvement in the temperature effect was obtainable. They have designed a new magnet system in consequence, wherein a gold-plated iron frame is now used to hold the two magnetized gold-plated steel blades together, in place of the aluminum cube used in the old system. The lateral screws are of improved construction and the threaded bars holding them are made of materials having a high and low temperature coefficient. With proper adjustment this makes possible almost complete compensation of the effect of temperature on the system. No change in the sensitivity screw was made. Inasmuch as the new system is practically of the same size as the old one, it is necessary to make only a slight adjustment to install the new system in an old magnetometer of Askania make. Advantages are claimed for the new system. No longer does the operator have to determine the temperature coefficient of his instrument accurately from time to time, also to read the temperature carefully at each set up and to wait until his instrument has acquired the outside temperature, particularly in the morning. Instead, he can move from station to station quickly, enabling him to work faster and in the long run more economically than with the previous systems. Inasmuch as this important source of error has been practically eliminated the operator may find it desirable to increase the sensitivity of his instrument, particularly where the magnetic anomalies are small, and thus use it on problems which so far have had to be neglected because of temperature errors.

Materials Handling by Magnet

For handling scrap iron and small castings with ease about a plant the Bucyrus Erie Co., South Milwaukee, Wis., has equipped its Loadmaster portable crane with a 20-in. electro magnet. Power is supplied to the magnet by a 2 kw. Kohler electric plant mounted on the truck frame.

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BULLETINS

Cars—American Car and Foundry Co., 30 Church St., New York. Bulletin No. 102, industrial railways.

Haulage—Electric Storage Battery Co., Philadelphia, Pa. Booklet on switching locomotives.

Rubber—Diamond Rubber Co., Inc., Akron, Ohio. Mechanical catalog.

Insulators—American Lava Co., Shattanooga, Tenn. Catalog No. 32, lava and magnesia.

NEWS OF THE INDUSTRY

Spence and Kidd Report on Great Bear Deposits

An important source of radium, a budding high-grade silver camp, and a possible copper producer—this epitomizes the possibilities of Great Bear Lake as pictured by Messrs. H. S. Spence and D. F. Kidd, the representatives of the Canadian Department of Mines who examined the area last summer, before the Ottawa members of the Canadian Institute of Mining and Metallurgy. Dr. Kidd, who made a preliminary survey east and northeast of the lake for a length of over 100 miles, outlined the geological features.

The native silver and radium occur in the same or adjacent veins in fracture zones in volcanic rock not far from a contact with granite. Copper deposits east of the lake occur mainly in the large veins, 50 to 500 ft. wide, that constitute a striking feature of the landscape as seen from the air. Only occasionally is the quartz of these veins mineralized, but even so they are capable of yielding large deposits of ore from a small part of their bulk.

Mr. Spence described in detail some pitchblende-silver veins on Labine Point and thereabout. The "breaks" in which they occur are 8 to 16 ft. or more wide and the veins themselves, exclusive of disseminated material on their borders, vary up to 14 in. wide. In places disseminated wire silver occurs over a width of several feet, suggesting the possibility of comparatively great widths of milling ore. Mr. Spence's sampling indicates the grade of both the radium ore and the silver ore, though obviously determinative results can be obtained only by bulk sampling, which was not possible this year. A sample from the discovery pit on No. 1 vein on Labine Point gives 112 mg. radium per ton (or nine tons of ore to one gram of radium, worth at the present price $50,000). A typical sample from No. 2 vein contains 28 per cent quartz gangue with the pitchblende and runs 51.9 per cent U_3O_8, yielding 132 mg. radium per ton. Another sample from No. 2 vein farther east contains the same amount of radium and 736 oz. of silver, exclusive of the silver vein beside it.

The silver veins proper contain from a few hundred up to 9,000 oz. per ton, the latter value being for a width of 6 to 8 in. in one of the pits. The average grade of the disseminated silver-bearing material adjoining the veins has still to be determined. No. 2 vein has been opened in frequent pits for a length of over 1,000 ft. On the adjoining Bonanza group of claims, though widths and grade are good, the veins have not yet been exposed for any great length. Some miles inland similar radium-silver veins were found late in the season.

During the last two weeks of the season several expeditions came in by the air route to stake claims. The district is accessible by airplane from the railhead at McMurray, 750 miles south, during the summer flying season of ten weeks, ending about Sept. 10. Later on the 'planes are equipped with skis for use on the ice.

■

Page Shaft at 1,500 Level

Cutting of the station and skip pocket at the 1,500 level of the Page lead-zinc mine, of Federal Mining & Smelting, in the Coeur d'Alene district, Idaho, should be completed within a few days. The shaft, previously bottomed at the 1,200 level, was completed to 1,500 ft. at the end of October. Crosscutting to the vein, a distance of 700 ft., will be undertaken when station work is completed.

■

Yellowgold Property Bought

A. P. Toney, of Searchlight, and Hugh Shamberger, of Las Vegas, Nev., have purchased the Yellowgold Mining & Milling property, 35 miles south of Goldfield. The property was controlled by John J. Carr, of Tonopah. Development will be started at once. Recent work done under Mr. Carr's management showed a new vein, paralleling the main vein, with a width of 20 ft. The tunnel in which this vein was cut will be continued to the main vein.

■

New Yankee Tramway Started

Operation of its recently completed 4-mile cable tramway, linking its Yankee mine, in American Forks Canyon, with the loading station on the road to Pleasant Grove, Utah, has been started. The tramway eliminates a long and expensive haul by trucks and will cut transportation costs considerably. About 50 tons of copper-gold ore will be shipped daily for the present, but the tonnage will be increased to about 100 tons.

■

Develop Gold in Tennessee

Existence of a large gold deposit in the White Oak Mountains, near Ooltewah, Hamilton County, Tenn., is indicated according to a survey made by Andre Formis, mining engineer of Chattanooga, formerly with U. S. Steel, Ojibway Copper, and Universal Exploration. The ground on which the deposit lies is held under lease by L. J. Morris and S. A. Morris, of Chattanooga, who control about 1,700 acres in all. Assays made in Cincinnati indicate an average grade of about $6 a ton, according to Mr. Formis.

Mining Congress Will Aid "Practical" Silver Plan

Without indorsing any particular plan, the American Mining Congress, at its annual meeting held in Washington, Dec. 3 and 4, adopted a resolution pledging its aid to any practical methods that may be brought forward for the stabilization of silver. The resolution was drafted by the Utah Chapter of the Congress. After some modification it was adopted by unanimous vote in the following form:

"Whereas, the expansion of credit beyond the supporting power of its metallic gold base has been a prime factor everywhere present in the world-wide business depression, with consequent disastrous fall in commodity prices which has made unprofitable the production and exchange of goods and services; and,

"Whereas, metallic money reserves, nonfluctuating as to value, are essential to minimize undue inflation and deflation, to restore the orderly processes of industry and trade and to maintain them in periods of prosperity and depression alike; and,

"Whereas, domestic industry and trade can be greatly stimulated and improved through expansion of foreign markets, which, in turn, can be most effectively developed through encouragement of the production in all countries of the commodities each country can most advantageously provide for sale to other countries; and,

"Whereas, large and important productive and consuming areas of the world employ silver as a money medium, and the buying power of silver-using peoples has been largely destroyed by the sharp decline in the comparative value of their money medium, with corresponding elimination of them from world markets; therefore be it,

"Resolved, by the American Mining Congress, that it hereby pledges its assistance and support to such acceptable practical methods as may be presented for the stabilization of silver so as to permit its employment wherever needed as money and as a monetary and credit base and enable silver-using peoples to participate under equitable conditions in trade with peoples that employ gold for such purposes."

Officers for the ensuing year were elected or reelected as follows: president, S. Livingston Mather, Cleveland-Cliffs Iron, Cleveland; first vice-president, A. E. Bendelari, Eagle Picher Lead, Cincinnati; second vice-president, J. B. Warrener, Lehigh Valley Coal & Navigation, Philadelphia; third vice-president, D. D. Moffatt, Utah Copper, Salt Lake City; secretary, James F. Callbreath, Washington, D. C. Directors were elected as follows: Charles G. Berwind, Philadelphia, Berwind White Coal; R. E. Talley, Clarkdale, Ariz., United Verde Copper; Frank H. Crockard, Birmingham, Woodward Iron; C. J. Ramsburg, Pittsburgh, The Koppers Company. Charles C. Whaley, of Nashville, was elected president of the Manufacturers' Division.

President Mather analyzed the returns from a questionnaire which had been sent out in advance to all members. The membership of the Mining Congress is scattered among 43 states and is said to represent 87 per cent of the mineral production of the country. Returns from the questionnaire show that 90.7 per cent of the membership favors a continuation of the campaign for clarification of the Sherman law. Practically unanimous endorsement was given the taxation work of the Mining Congress which looks to the "safeguarding of the principles of depreciation, obsolescense, and depletion of the wasting of mineral industries."

The policy of the Mining Congress in advocating such import duties as will equalize costs of production here and abroad was supported by 83.1 per cent of the membership. On the question as to whether the Mining Congress should continue its campaign for mechanization, affirmative answers represented 87.2 per cent of the membership. Some opposition was voiced to adoption of a shorter working week. Fourteen per cent of the membership voted no, but those voting in the affirmative represented 68 per cent of the total membership. Activities looking to the maintenance of harmonious relations between capital and labor was indorsed by 82.5 per cent of the membership.

Another question was "Shall we expand our present publicity facilities in order that there shall be complete understanding of mining, its problems and laws?" Affirmative answers represent 80.8 per cent of the membership and the negative answers, 8.4 per cent. Continued opposition to the entry of government into the field of private business was approved with practical unanimity. A negative vote of 10.5 per cent of the membership was cast against cooperation by the Mining Congress in work looking to the development of money media everywhere stable in value.

Little opposition was registered to the organization of a cooperative committee to contact with the federal agencies dealing with mining or to a committee to coordinite the work of organizations dealing with mining problems.

A consolidation of three existing divisions of the Mining Congress into a "modern mining" division was approved at the meeting. The new division absorbs and enlarges the work which had been done by the mechanization committee and will deal with matters pertaining to the mining machinery shows and the issuance of the year book. The chief concern of the new division is to secure exchange of information among coal operators on all phases of mining underground and of coal cleaning. In support of this change it was pointed out that mining is going through the evolution from a hand labor industry to one using machine methods. The safety work of the congress also will be under the direction of the modern mining division.

In the course of remarks before the meeting, Scott Turner, Director of the U. S. Bureau of Mines, among other things, said: "The main purpose of the Bureau of Mines is to be helpful to the mining industry. We have no right or wish to enforce laws, impose penalties, or exercise police control. We function through voluntary cooperation with the industry. We extend our services to other governmental agencies, educational institutions, technical and economic groups and societies, and to other countries. The difference between our needs and our funds is becoming wider, but we recognize the necessity of reducing government expenditures. The past two years have been trying ones; evidently, more are to follow. I have been proud of the way in which the mining industry has met adversity. Mines are kept going, unemployment is held at a minimum, and mineral production continues, although at reduced rates. To meet the situation, methods have been improved, equipment has been rearranged, costs have been cut, and the problems involved in improving distribution, marketing, and consumption are being studied."

Curtailment of public expenditures, federal, state, and local, was endorsed by several speakers at the meeting of the tax division of the congress. Dr. T. T. Read, professor of mining at Columbia University, suggested studies of mine taxation through college fellowships. In this way he believes more general attention could be called to social effects of taxing the mining industry as though mineral reserves were productive property.

■

Nipissing Buys Beattie Shares

Nipissing Mines has concluded an agreement with Ventures whereby it will obtain an interest of 40 per cent in the Beattie gold property, Duparquet Township, Que., in return for aid in financing construction of a mill. The maximum Nipissing investment will be $1,120,000, but it may be much less. Nipissing already owns a considerable acreage adjoining the Beattie property.

According to a statement by Hugh Park, Nipissing manager, mining and milling costs are not expected to exceed $2.25 a ton, on the basis of the initial milling unit of 1,000 to 1,500 tons daily. At present, more than 5,000,000 tons of ore averaging $3 a ton is in sight. This ore is above the 500 level. Recent diamond drilling, according to Canadian reports, indicates a second ore zone at a depth of about 700 ft.

■

Dix-Butte Changes Hands

New York capital has taken over Dix-Butte Placer Mining, which owns 640 acres in Butte County, Calif. Louis E. Whicher, vice-president of United Verde Extension, will probably be selected president of Dix-Butte, and Richard M. Atwater, of Ladenburg, Thalmann & Company, New York brokers, is to be vice-president. The consummation of the arrangement was made after an examination and report on the property by Charles Scott Haley. The Dix-Butte is a well-known placer property through which the Willard Dyke passes. The property was taken over about three years ago by Frank Maloney, of Reno. He stated at the time that former owners had expended about $200,000 on the property and driven about 2 miles of tunnel, drifts, raises, and crosscuts. His plan was to continue the tunnel to a point under the old river channel and raise to the bed. Cost of this work was $55,000, Maloney stated. With new capital no doubt the plan will be completed and the tunnel driven ahead 300 ft. to reach the east channel.

Roan Antelope Report Shows Per-Pound Costs of 7.85c.

Roan Antelope, new copper producer of Northern Rhodesia, estimates in its progress report covering the quarter ended Sept. 30 that its production of 7,374 long tons of electrolytic copper during that quarter was obtained at an average cost of 7.85c. a pound. This cost includes allowances for losses in transit, smelting, refining, selling, and royalty, but does not include interest or depreciation. The company has an issue of £1,500,000 of 7 per cent debenture stock. The interest is £26,250 a quarter, equivalent to a charge of almost £4 per ton on the September quarter output. This is nearly 1c. per pound of copper. As production increases, however, this charge will drop and at capacity will not exceed 0.5c. per pound of copper.

The month of September showed a cost of only 7.17c. per pound. Since then, the abandonment of gold parity in Northern Rhodesia, plus the fact that starting of the smelter has greatly reduced transportation costs, should result in further reductions in Roan costs. As Roan pays its labor in depreciated pounds, but sells its copper on the basis of the New York price, the drop in currency is a decided advantage. The figures for the September quarter are all in gold-parity pounds and show costs of £36.129 per long ton of copper.

Shipments of copper concentrate during the quarter totaled 13,299 short tons, averaging 57.85 per cent copper, a copper content of 15,387,498 lb. In addition, the smelter bins held 2,070,300 lb. of copper in concentrate, awaiting treatment. For the quarter, the recovery of copper was only 73.96 per cent of the total copper content of 3.47 per cent copper. Recovery of the sulphide copper content was 84.58 per cent. Milling costs, exclusive of drying and sacking, were only 1.3s. per ton in September, or about 31c. a ton. This compares favorably with the best results achieved in the United States. Mining costs in September were 5.23s., or about $1.25, per ton.

Roan Antelope treated 168,900 tons of ore during November, against 204,000 tons in the preceding month. The ore treated last month averaged 3.85 per cent copper, against 3.28 per cent in October. During November the company shipped 3,001 short tons of concentrate, assaying 55.4 per cent copper, and 3,182 tons of blister copper.

■

Scossa Ore Gives High Yield

A 32-lb. shipment of ore from the new gold camp at Scossa, Nev., north of Lovelock, has yielded $80 per pound in gold, according to returns received by Dawes Gold Mines, which made the shipment, from the International smelter, at Tooele, Utah. The ore was obtained from the face of a stope on the 180 level. Several sacks of similar ore are reported to be stored in the bank at Lovelock. Dawes Gold holds the original discovery ground at Scossa. S. V. Seymour has incorporated Imperial Gold Mines to operate the Overhang and Hurry Up claims at Scossa. The Overhang adjoins Dawes Gold on the west. Scossa Gold Mines, operating the Wild Animal claim, has erected a headframe and is installing a small hoist.

Old Dominion Prepares for Permanent Shutdown

According to an announcement by I. H. Barkdoll, general manager, the board of directors of Old Dominion has decided to abandon the workings of the Old Dominion copper mine at Globe, Ariz., in that portion of the mine below the No. 12 level. The mine Diesel engine plant and the No. 12 level pumps will continue to operate for the present to take care of present water contracts, but the rest of the mine will be permitted to fill. If the income from sales of water can be made sufficient to cover the cost of operation of the Diesel plant and No. 12 level pumps, they will be kept running permanently.

The principal purchasers of Old Dominion water at present are Miami Copper, which uses the water in its concentrator, and the city of Globe, which buys water for domestic use at the mine. The reasons given by the directors for the permanent shutdown are the continued depression of the copper market and the excessive expense of keeping the mine open. Old Dominion has been producing about 10,000 tons of copper a year for many years, but it has not paid a dividend since 1919. Although a large, low-grade orebody was found on the Nos. 23 and 24 levels, production stopped in September, 1931.

■

Tonopah Ex. Fails to Reopen Despite Announcement

On Nov. 7 Thomas F. Cole, general manager of Tonopah Extension, arrived in Reno, Nev., direct from Tonopah. In a newspaper interview Mr. Cole stated that, "As one of the first results of the enhancement in the price of silver, work was resumed today in the Tonopah Extension mine through the McKane shaft, and the result is a renewal of confidence at the big silver camp." Before publication a proof of the story was submitted to Mr. Cole, and after a few minor corrections he placed his OK on the proof over his signature. The news was considered of such importance that it was wired all over the country by the Associated Press.

The statement by Mr. Cole was a surprise to the people of Tonopah, particularly to Homer Williams, superintendent of Tonopah Extension. In an interview a few days later Mr. Williams stated that he had not received any such instructions from Mr. Cole, either verbally or by mail or wire. He said that only four men had been at work in the McKane shaft for over one month. The wide publicity given Mr. Cole's statement brought a flood of inquiries from miners seeking employment and many came into the camp expecting to find employment in a market already oversupplied. The deluded miners came in such numbers that the Tonopah Chamber of Commerce took action and requested the Associated Press to give denial to the report.

To date no material changes have been made in the number of men employed at Tonopah Extension. A little ore is being saved from upper levels in the neighborhood of the McKane shaft. The Swanson lease, working through shaft No. 1, is in high-grade ore and has made shipments amounting to three carloads of ore running around $56 per ton. This ore comes from Tonopah Extension ground and the lease has been in operation some months. In his Reno interview Mr. Cole laid particular stress on the statement, "That the main object in resuming work at this time is to provide employment for miners and thus aid in bettering the unemployed situation and that with silver at 34c. or better this could be done." Continuing he further said, "Operations were started on and above the 1,200 level, where there is considerable tonnage of ore ready for extraction."

Later silver sold considerably above 34c. an ounce, but no move was made to put more men at work. To date Tonopah Extension has not perceptibly relieved the unemployment situation in Tonopah.

Notice to Subscribers

THE change in publishing policy to take effect in January, 1932, announced elsewhere in this issue, involving the consolidation of *Engineering and Mining Journal* with *Engineering and Mining World,* and the issuance of a monthly magazine under the original title, permits a revision of subscription rates, as follows: United States of America and possessions, $3 per annum; Canada and other countries of the Americas outside the United States, $4 per annum; elsewhere, $5 or 25 shillings per annum. Subscriptions of existing subscribers to *Engineering and Mining Journal* at home or abroad will be extended in proportion to the reduction in the rate.

■

Anaconda Copper Cuts Wages

Anaconda Copper has reduced all wages at its properties in Montana 50c. a shift, effective Dec. 1. Anaconda thereby follows the action, taken two months ago, of most of the other leading domestic copper producers and brings its wage scale to the lowest rate that has prevailed since 1921. The base rate at the Butte mines will be $4.25 a shift, on this basis. Notice of the cut stated that "the action has been deferred in the hope that better prices and also a better market demand would prevail."

■

Cut Shasta County Freight Rates

Ore freight rates from Shasta County to the Selby smelter, at Selby, Calif., have been reduced and are now $2.50 per ton for ore up to $15 per ton in value; $3.50 per ton up to $20 per ton in value, and $4 per ton up to $30 per ton, based upon a minimum carload of 40,000 lb.; upon a minimum carload of 80,000 lb. the rate becomes $3.20 per ton up to $20 per ton in value and $3.90 per ton up to $30 per ton in value.

Deal Made for Bingham Claims

U. S. Smelting, Refining & Mining and Utah Copper have jointly acquired Bingham Bemis Mining claims at Bingham, Utah, from George L. Bemis, who controlled property, consisting of 240 acres, near the mouth of Bingham Canyon. Under terms of the arrangement, U. S. Smelting acquired underground rights and Utah Copper, surface rights for dumping purposes. The limestone strata, in which the large silver-lead deposits of the district are found, lie about 500 to 1,000 ft. below the old workings.

■

Northwest Magnesite Reopens

One hundred men were put back to work at the quarry and plant of Northwest Magnesite at Chewelah, Wash., recently, following a shutdown. J. C. Hutchinson, manager, reports that the plant will run on a steady basis. This property was the only producer of magnesite in Washington in 1930, operating at about one-third of capacity.

■

Missouri Gold "Boom" Over

The gold "boom" in St. Louis County, near Allenton, Mo., has been exploded by the reports of three government assay offices indicating that samples submitted did not run more than $4 in gold per ton. This finding has been substantiated by private tests made by a metallurgist from New York, retained by Rock Hill Quarries, which had planned to develop the gold-bearing lands if the metal was found in paying quantities. Hopes ran high last July when some metallurgists assayed samples of rock at $24,624 a ton. Rock Hill then sent three 50-lb. samples from each of four farms on which it had taken options to each of three government assay offices in the West, for more complete tests.

■

Baker Island Mine Builds Mill

In view of recent gold discoveries made on the Galvin molybdenum property, near San Antonio Bay, Baker Island, Alaska, a mill will be erected as soon as possible. The presence of free gold in profitable amounts was determined by extensive exploration with a diamond drill this summer. Holes were put down over a mineralized zone of about 800 ft. in width and extending the full length of the Galvin property. In addition to the known molybdenum content, the drill tests showed gold values running from $2 to $13 per ton.

Work has already started upon a dock at San Antonio Bay, as well as on construction of the mile of road needed from dock to mine. Surface buildings adequate to house the crew during construction of the mill were erected early this fall at the mine. The property is owned by J. G. Galvin, of Seattle. W. M. Reese is the mining engineer.

Consolidated and Eagle-Picher to Merge Tri-State Units

Stockholders of Consolidated Lead & Zinc were to hold a meeting on Dec. 11 to act upon the proposed merger of the company with Eagle-Picher Mining & Smelting. The arrangement has been approved by the boards of the two companies. Consolidated would dispose of all its holdings to the Eagle-Picher company, except cash amounting to $85,000, for 80,000 shares of Eagle-Picher stock and an additional 20,000 shares if a lease on certain mineral lands is extended.

Consolidated Lead was formed in December, 1924, to take over three mines in the Joplin district owned largely by officials of Eagle-Picher Lead. In February, 1926, Consolidated was merged with the Underwriters Land Company, which at the time owned four mines in the district. In 1927 the Consolidated company purchased the Tulsa-Quapaw, Domada, Baby Jim, and Kitty mines and the royalty interests of Wright Mining & Royalty for about $1,000,000. Eagle-Picher Mining & Smelting Company, a subsidiary of Eagle-Picher Lead, was formed late last year to take over the mining and smelting interests of the parent company in the Tri-State district.

Ratification of the merger by the Consolidated owners probably will result in the building of a large central mill by Eagle-Picher, plans for which have been in the making for a year. The plant probably will be of 3,600-ton capacity daily, as compared with the 2,400-ton capacity of the Bird Dog mill of Commerce Mining & Royalty, the largest operating plant in the field. If the large plant is built, Eagle-Picher probably will dismantle fifteen or twenty of the smaller plants now owned, each with a capacity of from 25 to 50 tons per hour. As these small plants now stand, mostly upon 40-acre tracts, they cannot be operated near capacity and the mines would be crowded to furnish sufficient ore to keep the mills operating on only a 10-hour basis.

Through the adoption of continuous operations and many new metallurgical advances, company officials believe that a much lower concentrate cost can be obtained, making possible the operation of the plant at a profit in periods of low prices and enabling the mining of huge reserves of low-grade ores in periods of high prices. Arrangements for milling ores at a central mill from a large number of separate fees have been consummated.

■

Jefferson Lake Sulphur Unit

Construction of a new sulphur plant at Abbeville, La., has been started by Jefferson Lake Oil, which has obtained a lease from the State covering the bed of Lake Peigneur. Extensive exploration has revealed the existence of a sulphur deposit, a large salt dome, and some evidence of oil, according to Arthur Barba, Sr., president of the company. About $500,000 has been spent in preliminary work at the property. The initial plant will have a capacity of about 100,000 tons annually. The main building is 70x100 ft.; other structures include a warehouse, office buildings, an 80-ft. water tower, a 15,000-bbl. oil tank, 50 acres of sulphur vats of 1,000,000-ton capacity, two 8-in. water wells, and a quadruple 6,000-ft. pipe line from the deposit to the plant. It will be completed in four months.

■

Neal Again Elected to Head Tri-State Association

Charles A. Neal, of Miami, Okla., was reelected president of the Tri-State Zinc and Lead Ore Producers' Association at a meeting of the new board of directors held recently. George W. Potter, vice-president of Eagle-Picher Lead, was reelected first vice-president; M. F. Owens, manager of Black Eagle Mining, second vice-president, succeeding W. T. Landrum, of Cortez-King Brand Mines; and L. G. Johnson, superintendent of Federal Mining & Smelting, was reelected treasurer.

Directors face a task in balancing the organization's budget to meet the present revenue. In the first few years of the organization a surplus of about $65,000 was amassed. In the past three years that surplus fund has dwindled to about $5,000, and the contemplated revenue for the coming year, based on present production and sales, will be less than $20,000. Budgets for all but the past fiscal year called for expenditures of around $60,000. The budget for the past year called for an expenditure of slightly more than $40,000.

The revenue of the organization is derived from an assessment of 15c. a ton on all concentrates sold. Some members failed to sell any of their production last year, and thus did not pay any money towards maintenance of the organization. The estimated revenue, according to present sales, will not be much more than $15,000 for 1931. The organization hopes to raise the balance by having some holders of reserve stocks pay advance dues against concentrates in bins to bring the revenue above the $20,000 mark. Salaries of the employees are being slashed and some of the personnel of the institution, it is understood, will be laid off. Membership in the organization has suffered also, through the depression.

■

Fresnillo Output Maintained

The report of Mexican Corporation for the quarter ended Nov. 19 indicates little change in the total volume of production at Fresnillo, Zacatecas, Mexico, but a larger tonnage is being obtained from the Santa Ana tailing deposit and a smaller one from the oxide orebodies. Development of the sulphide orebodies at depth was continued. At the end of the quarter, 991 ft. of ore has been opened on the 560-m. level, compared with 512 ft. at the end of the previous quarter. The grade and width of the new ore, however, was not so good as that previously opened. On the 470 level, work in the main oreshoot developed material considerably wider than the mine average and with a higher silver and copper content. On this level, 1,306 ft. of ore has been developed, and on the 515-m. level, 1,148 ft. The 425-m. level, where work has been completed, opened 2,977 ft. of ore.

General Manganese to Build Mill at Chamberlain, S. D.

Construction of a concentrator, with capacity to produce 50 tons of high-grade manganese ore daily, is being undertaken by General Manganese, holding property near Chamberlain, S. D. Winston Brothers, contracting firm of Minneapolis, which does some work in the Minnesota iron districts, will mine the ore under contract. The unit now under construction is planned as the first of ten, each with 50-ton capacity. E. P. McCarthy, consulting engineer of the company, has been negotiating with railroad officials over transportation facilities. Chamberlain is on the Chicago, Milwaukee, St. Paul & Pacific Railroad.

The Chamberlain deposits occur in a zone of shale, about 35 to 40 ft. thick, covering an area of at least 56,000 acres. General Manganese is said to control 80,000 acres of ground in all. According to an estimate made by John A. Savage & Company, of Duluth, the tonnage available is 50,000,000, averaging 16 per cent manganese and 8 per cent iron. This would have to be concentrated to at least 40 per cent manganese to be of commercial value. Whether the new plant being built will use the Bradley Fitch leaching process, said to be particularly suitable to Chamberlain ore, is not known.

■

Close Cape Manganese Mines

Production has been suspended by Manganese Corporation (1929), Ltd., which has been operating the properties at Postmasburg, Cape Province, South Africa. Reserves of ore in this field have made it an important potential source of supply comparable to India, Brazil, and Russia. Production was started in 1930 and reached about 20,000 long tons monthly. The present world crisis has cut shipments, however, and in view of the mounting stocks, the officials felt justified in suspending work. Any demand for ore can be satisfied from the stockpiles until production is again resumed.

Shipments in recent months have been: April, 14,081 tons; May, 19,111 tons; June, 13,736 tons; August, 1,911 tons; and September, 8,265 tons. Average grade of the ore is over 50 per cent Mn. Negotiations are still being carried on with the object of producing ferromanganese in South Africa and also making contracts for regular shipments of manganese to other parts of the Empire.

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Tunnel Driving at Hoover Dam

Two of the pioneer tunnels, Nos. 2 and 3, being driven to divert the waters of the Colorado River in the huge Hoover Dam project, near Las Vegas, Nev., and Kingman, Ariz., have been completed. The tunnels are 12x12 ft. Two others are still being driven. Total length of the four tunnels will be 15,935 ft., of which 12,915 ft. had been completed on Nov. 21.

BRIEF NOTES

Amelia to Reopen Mines. Announcement of the reopening of the Rutherford mines, in Amelia County, Va., has just been made by the Amelia Mines & Minerals Corporation. The mines are 1 mile north of Amelia Court House. Presence of albite, microline, muscovite, garnet, tourmaline, microlite, and beryl is reported. Operations have begun under the direction of the engineer in charge, James C. Hobday.

Bahia Corporation Output. In October, Bahia Corporation, operating diamond properties in Brazil, reports production of 600 karats of black and white diamonds, according to Arthur S. Bandler, president of Bernard Bandler & Sons, Inc. This is the highest monthly production recorded since the company started operations.

Bradshaw Closes for Winter. Bradshaw, Inc., operating the tailings pond of the Goldfield Consolidated, at Goldfield, Nev., has been forced by cold weather to shut down for the winter. The last two weeks of operation of the plant was under difficulties. The solutions, however, were kept moving to preclude their freezing. Bradshaw, Inc., recently declared its twelfth dividend of $10,000, making a total of $120,000 paid to date. Mark Bradshaw, in Reno last week, states that his plan to treat the tailings of the White Caps at Manhattan has been abandoned for the present. At a recent meeting of White Caps directors to ratify the agreement some opposition developed, and Mr. Bradshaw withdrew his offer.

Carnation Starts Production. Carnation Gold, operating the Jamison mine, on the Mother Lode, in Plumas County, Calif., reports that production from its new mill has been started. The property of the company totals 881 acres. According to G. A. Washington, president, average grade of the ore above the 500 level is $9 in gold per ton. About 1,000 hp. of hydro-electric power is available. Robert J. Jefferson is managing director of the property.

Electrolytic Zinc Output Up. Although the price of zinc was much lower during the fiscal year ended June 30, 1930, than in the previous year, production at the Risdon plant of Electrolytic Zinc, in Tasmania, increased from 54,150 long tons to 55,282 tons. Demand for sulphuric acid was considerably restricted, because of the unfavorable agricultural situation, and output was cut to 58,928 tons. At the company's mines near Zeehan no work is now under way. Development early in the fiscal year increased the stocks of broken ore on the surface to nearly 40,000 tons. At the Risdon plant, construction of the fourth unit, which would bring production capacity up to 70,000 tons of zinc annually, has been temporarily suspended.

Gold Standard Sinking Shaft. A three-compartment shaft, 7½x17 ft., has been started by Gold Standard Mining, to explore a tract of 1,237 acres of placer ground near San Andreas, Calif. The acreage is along the Central Hill and other ancient river beds. The shaft, now at depth of 60 ft., will have to go to 300 ft. to reach the bedrock. At that depth lateral operations will be started to explore the surrounding territory. This is said to be the largest shaft in Calaveras County, Calif.

Hecla Nets $43,178 on Union Ore. The net return from the Bunker Hill smelter for the carload of high-grade ore shipped from its Union mine, near Grand Forks, B. C., by Hecla Mining, was $43,178. The carload contained 54 tons. In addition to nearly 40 oz. of gold to the ton, the ore assayed 8 per cent lead, 7 per cent zinc, and 18 oz. of silver.

Inco Completes Frood Exit. International Nickel has completed installation of a combination airway and emergency exit at its Frood mine, the last item in its four-year program of construction in the Sudbury area. No. 1 shaft has been extended to the bottom level of the mine and concreted. A reinforced concrete fan building, concrete collarhouse, steel headframe, and tile-and-steel hoisthouse have been built. An electric double-drum hoist, with a rope speed of 600 ft. per minute, will handle two cages, operating in balance.

Itogon Mining Progress. Driving of the new tunnel on the 1,400 level, at the Itogon Mining property, in the Benguet gold district, Philippine Islands, is progressing favorably, according to J. O. Ensberg, superintendent of the company, and the main ore-bearing lodes should be cut at the end of this month. The tunnel is 150 ft. vertically and 200 ft. on the dip below the No. 1 level on the Taka vein system. The mill is being operated at capacity of 180 tons daily on Taka and Sesame ore.

Lena Negotiations Fail. The negotiations which have been held in Berlin between Soviet Russia and Lena Goldfields, for the purpose of settling the claims of the latter against the former, have failed. In 1930, an Arbitration Court, meeting in London, gave a verdict to Lena Goldfields calling for the payment of about £13,000,000 or the estimated profits contained in the Lena concessions. The judgment was not accepted by Russia, which was not a party to the hearings. At the Berlin conferences, the company stated that it would accept £5,000,000, but the Soviet offered only £800,000. German creditors are sending representatives to Moscow to settle their claims.

Mount Isa Reserves. A recalculation of Mount Isa ore reserves places them at 19,120,000 long tons, 11,000,000 tons considered unprofitable at present metal prices having been eliminated. In the five months to October, 154,434 tons was treated, assaying 12 per cent lead and 6 oz. silver, the average extraction being 78 per cent of the lead and 85 per cent of the silver. A Mining Trust report states that Mount Isa and Britannia Lead have arranged that American Smelting & Refining take full charge as technical managers for ten years. A. S. & R. agrees to lend the two companies up to $1,000,000 at 6 per cent without commission, for general purposes, and to bring the Mount Isa output up to rated capacity of 6,000 tons of lead monthly.

Mount Coolon Mill Plans. Mount Coolon Gold, 80 miles from Collinsville, Queensland, will build a 200-ton mill to treat its ore. Fine grinding and cyanidation will be used, with an expected recovery of 92 per cent of the gold content. As the ore averages over 1 oz. in gold per ton, monthly production should approach 5,000 oz., which would make the company the third largest gold producer in Australia. Transportation to the railroad at Collinsville is expected to cost £2 10s. to £3 10s. per ton. In addition to mill, power plant, transport equipment, sawmill, and employees' houses, the company will build a 100,000,000-gal. reservoir 6 miles from the mine.

Newpass to Open Superior. Newpass Mining, which owns the Gold Belt and Superior mines, 25 miles northwest of Austin, Nev., is installing a five-drill Ingersoll-Rand compressor at the Superior mine, which will now be developed. Previous work has been largely in the Gold Belt property. A 50-ton mill built at the mine about eighteen months ago later had to be moved 5 miles down the canyon because of lack of water supply. The mill was started in September, when output was $18,000. Readjustments have increased output since then, the November yield being about $25,000.

Pioneer Shaft Progresses. Rapid progress is being made with the new three-compartment shaft at the Pioneer Gold mine, in the Bridge River district. The raise from the 1,000 level is, according to present expectations, to be completed within two months. Sinking from this level has now been carried a distance of 125 ft. At that depth a station has been cut.

Searchlight Plans Additions. According to a statement by W. J. Loring, general manager of Searchlight Gold Mining operating the old Duplex mine, at Searchlight, Nev., more than $60,000 in gold has been taken out during work of reopening. He also announced plans for doubling the capacity of the present 60-ton mill, installation of a central power plant and a new compressor, and later the sinking of a new working shaft. The present mill is handling about 120 tons a day of tailings that average about $5 per ton in gold. The mine is credited with a total production of $1,300,000.

West Mines Gets Gilbert Area. West Mines Corporation, W. E. Sirbeck, president, has taken over the Pearl claim adjoining Esmeralda Gold Mines, at Gilbert, Nev. In addition to shipping ore from its main shaft, known as the Green Gold shaft, Esmeralda Gold now has four leased blocks in ore. The main vein of Esmeralda Gold passes into the Pearl claim. A shallow incline shaft shows 4.5 ft. of vein at a depth of 20 ft. So far no shipping ore has been opened in Esmeralda Gold at a depth of less than 50 ft.

Winnetka Mining Mill Ready. Construction of a 50-ton mill at the Winnetka mine, about 4½ miles south of Virginia City, Mont., has been completed by Winnetka Mining. The plant will recover gold by table concentration and is completely electrified. R. A. Brett, of Pony, Mont., is president of the company, and Miss Ah Hee Yong, Chinese actress, who has decided to adopt mining as a career, is secretary.

Vote Copper Range Union With St. Mary's—Globe Work Ends

At a special meeting of the stockholders of St. Mary's Mineral Land, held in Jersey City, N. J., on Nov. 24, the proposal to turn over all the property and assets of the company to Copper Range, in return for Copper Range stock, on a share for share basis, was approved without opposition. Over two-thirds of the stock of St. Mary's was represented. Copper Range will act on the proposal at a special meeting of the stockholders in Boston, Mass., Dec. 14, the consolidation being contingent on the favorable action of the shareholders of both companies.

Diamond drilling by Copper Range in Globe lands, south of the Champion mine, has been completed for the time being. More drilling by Copper Range further to test the Baltic formation, in which copper values have been revealed in holes already drilled, probably will be undertaken later. The Globe lands are under option to Copper Range.

Costs in the Champion mine have been reduced in the last few months, and under normal operating conditions Champion can produce copper at 10c. a pound or better. Several factors have contributed to cost reduction, including cheaper power, a new method of mining, flotation in the Champion mill, and completion of construction work in the mill. The sublevel caving and retreating system in use in Champion has proved successful. Mechanical scraping and loading also are being used economically with this method.

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M.M.S.A. Hears Pros and Cons of Copper Tariff Debated

A well-attended meeting of the Mining and Metallurgical Society of America, held at the Engineers' Club, in New York, on Nov. 24, heard E. A. Peterman, P. E. Barbour, Arthur Notman, and W. W. Lynch discuss the question of a copper tariff. At the end of the prepared talks, some lively and occasionally pointed remarks were made, but the evening ended without any formal expression of opinion on the part of the Society.

Mr. Peterman, counsel for Calumet & Hecla and representative of domestic copper producers at the recent hearings in Washington, made clear that the advocates of the tariff were willing to admit that past performances do not indicate the need for an import duty on copper. However, he expressed it as his opinion that conditions in copper would materially change in the future. Instead of foreign consumption exceeding foreign production (with the United States exportable surplus supplying the deficiency), he expects the future to show foreign production considerably in excess of foreign consumption. The excess will then attempt to find a market in the United States, thus forcing high-cost domestic producers to close down. A tariff on copper, he admitted, would probably have to be followed by modification of the Sherman Act and other anti-monopoly acts.

Colonel Barbour presented an estimate of United States reserves of copper of 30,000,000 to 35,000,000 tons, which should be sufficient for the next twenty to thirty years without drawing on foreign reserves. Some domestic mines, he pointed out, have much lower costs than the leading African mines. In the other important producing groups, this country has an important equity. A careful estimate, he said, indicates that 75 per cent of the world's copper reserves are controlled by the United States. Instead of passing a copper tariff, he suggested, Congress should send the copper producers cards bearing the words "The Law of Supply and Demand" to remind them of its existence.

Mr. Notman presented as his chief objection to the tariff on copper the fact that, since domestic productive capacity exceeds domestic consumption, the tariff cannot be effective. No matter how the producers might stabilize the price in this country, it could not be maintained indefinitely at an artificial level. He particularly pointed to the glowing promises held forth to the wheat farmers of what a 43c. tariff on wheat would do for them, and cited the fact that wheat had sold for 45c. By analogy, he expected that a 4c. tariff on copper might be expected to bring 4c. copper.

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Open Hammond River Placers

Pay gravel running $5 per cubic foot was discovered this year on the Hammond River, in the upper Koyokuk River territory, Alaska. This area was prospected in early days, but a narrow channel lying in the center of the river was missed. As traced for 500 ft. by drilling, the channel is about 20 ft. wide and lies 9 ft. deep, with a rim on each side. Beyond the 500 ft. point the channel showed no sign of disappearing in size or value, according to E. J. Ulen, of Wiseman, Alaska. News of the find made known locally attracted many prospectors, but they found all ground in the vicinity well covered by new claims.

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Timmins Buys White Water

The White Water group of quartz gold claims above Tulsequah on the Taku River, British Columbia, has been sold to Noah A. Timmins for $125,000. Payment is to be made in three annual installments. Arrangements for the sale were made last July, when Mr. Timmins flew from Juneau to the property with his engineer, J. B. Woodworth, and the new owner will begin active development next summer. McNaughton Frazer, mineral surveyor of Vancouver, represented the former owners in the transfer. They are Walter Barron, D. J. MacDougal, Ray Walker, Arthur Hedman, and Ray Rice.

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Ford Buys Limestone Deposits

A large tract of land, comprising several thousand acres, in Chippewa and Mackinac counties, Mich., has recently been acquired by the Ford Motor Company. Limestone deposits on this property will supply flux for the blast furnace plant which is to be erected at Gladstone, Mich., in the near future by the Ford interests.

Develop New Refining Method for Texas Potash Ore

A new method of refining polyhalite has been announced by Dr. E. P. Schoch, director of industrial chemistry at the University of Texas. Large deposits of polyhalite exist in West Texas. The method, which does away with the expensive heating process formerly considered necessary to assure a separation of the potassium, magnesium, and calcium salts, is based on a reaction between the finely ground polyhalite and a hot solution of lime, which rapidly dissolves the potassium sulphate, leaving insoluble calcium sulphate and magnesium hydroxide as by-products.

Briefly outlined, the method involves agitation of the polyhalite for five minutes with enough lime and hot 3 per cent potassium sulphate solution to produce an 8 to 10 per cent solution of potassium sulphate. After filtration or centrifuging, the leach solution is evaporated to dryness to recover the potassium salt in crystalline form. The residue, consisting of gypsum and magnesium hydroxide, is treated with water saturated with carbon dioxide from flue gases, whereby magnesium will dissolve as carbonate and is separated from the insoluble gypsum by filtration. It is then precipitated by heating, filtered, and dried. Both gypsum and magnesia are recovered in marketable form and are valuable by-products in the process.

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Bulolo Plane Moves 3½ Tons

An upper tumbler shaft for one of the gold dredges now under construction in New Guinea by Bulolo Gold Dredging was successfully transported by airplane last month from Lae, on the seacoast, to the Bulolo dredging area. The tumbler shaft represented the piece of greatest weight, about 3½ tons, to be transported by airplane. It is said that the piece was flown over without difficulty and was landed without accident. This is in itself a major feat in airplane transportation. During less than four weeks in November, 310 tons of dredge parts and equipment was delivered by airplane from Lae to Bulolo.

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To Work Dos Cabezas Placer

Gold Gulch Mining, controlled by the J. F. Morrissey Company, of Fort Worth, Tex., has secured 1,760 acres of mining leases and claims in the Gold Gulch placer mining area in the Dos Cabezas Mountains, Cochise County, Ariz. The property has been examined by A. J. Harshberger, Tucson mining engineer. Assays made of samples taken over the entire property show an average value of $2.40 per cubic yard to a depth of 6 ft. Plans for the development of an adequate water supply and installation of machinery are already under way. The company expects to have the mine in actual operation within ninety days. D. O. Martin is in charge of operations at the property.

Lake View Report Shows Gain in Output, Profit, Reserves

London, Dec. 1.—Lake View & Star, leading producer of gold in Western Australia, reports that in the fiscal year ended June 30, 1931, substantial gains were shown in production, profits, and ore reserves. The mill treated 173,-111 long tons, for a yield of £564,676 (premium not included), or an extraction of 93.03 per cent of the gold content. In the previous year, £494,629 was recovered from 151,049 tons. These figures include ore purchased from leasers. The profit-and-loss account shows a balance, after working expenditures, of £102,118. This sum, together with the balance carried over from the previous year of £8,446, has been put into the development account except for £11,197 carried to the balance sheet.

. . . . Development work, particularly in the Horseshoe section, gave satisfactory results. At the end of the fiscal year, ore reserves were put at 1,431,453 tons of ore averaging 35.45s. in gold per ton. At the end of the previous year, they were 1,067,650 tons averaging 31.6s. per ton. Work in the Chaffers area is expected to start early next year. The remodeled surface plant and Chaffers shaft are nearing completion. About 20,000 tons of ore is now being treated monthly and within a few months, this will be raised to 30,000 tons monthly.

. . . . Ashanti Goldfields, leading West African gold mine, has declared a second interim dividend of 20 per cent, making a total of 50 per cent paid so far during the current year. Monthly returns indicate a net profit of 111¼ per cent on issued capital for the fiscal year. Last year, Ashanti paid 100 per cent on its capitalization at that time (£250,000) and then increased the capital of £375,-000, distributing the additional shares as a bonus. Mining men confidently expect a final dividend of 50 per cent, increasing the total payments for the year to £375,000.

. . . . Commonwealth Mines, a preliminary syndicate, reports good development at its alluvial properties on Agate Creek, in the Etheridge district, Queensland.

. . . . Kepong Dredging, operating in Selangor, F.M.S., plans to remodel the treatment plant on its tin dredges by placing the puddlers in parallel and installing a slow-speed puddler for experimental work. If successful, the company will order additional low-speed puddlers. Its fiscal year ended June 30, 1931, shows a loss of £4,521. The company reports an average grade of 1.33 lb. of tin concentrate per cubic yard treated, which is higher than the average in Malaya. Dredging is to a depth of 62.5 ft.

. . . . H. Frisby, chairman of Pahang Consolidated, at the annual meeting of the company, strongly opposed the restriction scheme now being enforced by leading tin-producing countries. He quoted clauses in the company's lease agreement which, if overridden because of the restriction plan, would make government leases in Malaya not worth the paper they are printed on, in his opinion. The company has appealed to the Superior court in the East. If it loses there, it will carry an appeal to the British Privy Council.

. . . . Pahang is one of the lowest-cost mine producers of tin in the world. In the year ended June 30, 1931, output was 2,799 tons of concentrate from 174,-100 long tons of ore, plus an alluvial recovery of 36 tons. The mine profit dropped from £63,693 in the previous year to £37,199. Despite curtailed development, ore reserves were increased 70,000 tons. Working costs were reduced from 26s. 11d. per ton crushed in 1929-1930 to 21s. 6d. in 1930-1931.

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Daggafontein Expects to Start on Jan. 1

Johannesburg, Dec. 1.—On Jan. 1 Daggafontein Mines expects to start operations at its new mill and cyanide plant, in the Far East Rand section of the Witwatersrand. Daggafontein will be the second large property to be brought into production on the Far East Rand within six months, East Geduld having started on July 5. Erection of equipment at the property has proceeded with record speed, actual construction having started only this year. From 1928, when work was resumed, to the end of 1930, about 1,230,000 tons of 8-dwt. ore was developed in this property. In the year that has since elapsed, additional ore of higher grade has been developed. Capacity of the plant will be 50,000 tons of ore monthly, indicating an output of nearly 20,000 oz. of gold a month.

. . . . The Rand continues to increase its production steadily (in October, 945,113 oz.), and there is no doubt now that 1931 will see established a new record output of about 10,800,000 oz. for the entire Transvaal. Considerable prospecting activity is reported in the North Rand section. Exploratory drilling is under way at Middelvlei, on the South West Rand. In addition, activity is to be noted in the entire area between the Far East Rand and Sub Nigel. Witpoort Gold Areas, holding ground adjoining Brakpan, on the Far East Rand, is being forced to suspend development because of exhaustion of its capital. This property, one of the General Mining & Finance group, estimated reserves of 365,000 tons of 6-dwt. ore at the end of 1930. The comparatively low grade makes the operation less attractive than other East Rand development areas.

. . . . The drop in the value of English sterling and the exchange difficulties that have resulted from South Africa's decision to adhere to the gold parity of 84s. 11d. an ounce is affecting all branches of industry in South Africa, particularly those that deal with Great Britain. Agriculture and base-metal mining have been hard hit. Government statistics show sharp declines both in the tonnage mined and in the value of South African output of tin, chrome, manganese, and asbestos.

. . . . A report from Northern Rhodesia states that production has started at the N'Kana mill of Rhokana Corporation.

Rhokana Reserves, Recalculated, Show Big Increase

London, Dec. 8.—Rhokana Corporation, which owns the N'Changa, N'Changa West, N'Kana, and Bwana M'Kubwa mines, in Northern Rhodesia, estimates its ore reserves on June 30, 1931, at 270,780,000 short tons of ore, averaging 4.3 per cent copper, an indicated copper content of 11,788,560 tons. The only company with larger reserves is Chile Copper. The new Rhokana estimate compares with previous official estimates for the four mines totaling 201,600,000 tons of 4.25 per cent copper, with a copper content of 8,575,000 tons. The increase came largely from the N'Changa and N'Changa West mines. Drilling late in 1930 and early in 1931 showed additional huge widths of high-grade copper at these two properties. None of these estimates include any ore from the Mufulira Mines properties, in which Rhokana has 30 per cent interest.

. . . . African copper producers (Union Minière, Rhokana, Roan Antelope, and Mufulira) met in London on Dec. 3 to arrange curtailment quotas under the new producers' agreement. Details of the closing of the N'Changa West mine were also to be arranged. This property, which carries the highest-grade ore of any of the mines, is still in a development stage. The metallurgical treatment of its complex sulphide-oxide ore has not been solved, and, although Rhokana had planned to ship some of the higher-grade sulphide ore to the N'Kana mill, little will be lost by delaying its exploitation. The new N'Kana mill is now ready to start [Johannesburg advices state that it actually is operating. —Editor].

. . . . Roan Antelope is building a holding furnace at its smelter. This will facilitate continuous casting. Lack of casting capacity somewhat handicapped the operation of this new Rhodesian plant when it was started in October.

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North Broken Hill Reserves

Despite a sharp curtailment of output, which included closing British mine, North Broken Hill reports that working costs at its properties in the Broken Hill district, New South Wales, Australia, were reduced from 37s. 8.2d. in the year ended June 30, 1930, to 30s. 11.2d. in the fiscal year just ended. The tonnage mined was only 292,825 long tons in the 1930-31 year, compared with 450,157 in the previous year. Ore reserves at the end of the year were 4,200,000 tons, showing no change. Production was 59,990 tons of lead concentrate, assaying 72.26 per cent lead and 43 oz. of silver to the ton, and 13,730 tons of zinc concentrate, assaying 51.6 per cent zinc.

The new shaft is now being sunk below 1,700 ft. and being put into condition for operation above 1,400 ft. North Broken Hill has completely dismantled its gravity equipment and is now recovering all of its output of concentrate by flotation only. An entirely new plant is being designed the chief feature of which is the replacement of 5x10-ft. tube mills by 8x4-ft. conical ball mills.

MARKET AND FINANCIAL NEWS

I. C. C. Publishes Freight Rate Increases to Start Jan. 1

Unless further complications arise, the increased freight rates authorized by the Interstate Commerce Commission propably will become effective Jan. 1. In its revised list made public Dec. 7 the commodities previously selected for increases of $3 and $6 per car will, in general, pay 6c. and 12c. respectively per short ton. Conversion to a weight basis was suggested by the railroads because cars vary in size. With reference to objections raised to imposition of a double increase on ore and coal moving through Lake and ocean ports, the Commission stated that because of the practical difficulties in the way of correcting this situation by general provisions, shippers and carriers would be left free to work it out between themselves.

Products formerly listed for an increase of $3 per car that will take an increase of 6c. per ton instead include anthracite and bituminous coal, coke, iron ore, copper and concentrates, lead ore and concentrates, zinc ore and concentrates, ores and concentrates not otherwise specified, and furnace slag.

Products of mines, n.o.s., that were previously scheduled for an increase of $3 per car now are divided into two classes. The following will take an increase of 6c. per ton: borate rock, bituminous rock, bituminous asphalt rock, iron pyrites, crushed or ground limestone, dolomite, earth or soil n.o.i.b.n., feldspar, fluorspar, fluxing stone, ganister rock, glass sand, crude gypsum, loam, molding sand, nickel matte, ore residue, crushed, ground, or scrap slate, volcanic ash. Products of mines that will take an increase of 12c. per ton are bentonite, china clay, ground flint, fireclay, gilsonite, ground gypsum (not calcined), kaolin, ground barium sulphate (barytes) not precipitated, ground barium sulphate (barytes) precipitated (blanc fixe), crude magnesium sulphate for kieserite, mica scrap or screenings, pipe clay, shale, slate not crushed, ground or scrap, soapstone (talc) ground, dust, lump, or rough slabs, crude chalk, clay, n.o.i.b.n., cobblestones, flint pebbles, and marble chips.

Products previously included in the list subject to an increase of $6 per car that instead will take an increase of 12c. a ton include crude phosphate rock, sulphur, pig iron, scrap iron and scrap steel, and rough stone. Asphalt, finished stone, and artificial stone previously designated for an increase of $6 per car will take an increase of 1c. per 100 lb. Soapstone forms or slabs, including firebox or furnace linings, have been added to the list of products taking an increase of 1c. per 100 lb. All freight, including l.c.l., not specifically designated for increase under the 6c. and 12c. per ton and 1c. per 100 lb. categories is subject to an increase of 2c. per 100 lb. The increase in rates under any category is limited to 10 per cent.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54
1928	99.78
1929	110.33
1930	82.87

	1929	1930	1931
January	106.86	102.94	67.62
February	110.37	102.28	65.90
March	122.71	99.93	68.03
April	116.36	93.24	64.45
May	110.03	83.41	59.81
June	109.66	78.57	58.23
July	109.58	74.58	59.54
August	109.81	74.41	58.05
September	109.29	73.42	57.09
October	106.52	60.63	55.08
November	106.09	71.39	54.91
December	104.75	70.65	.....

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Electrolytic Zinc's Year

In the fiscal year ended June 30, 1931, Electrolytic Zinc Company of Australasia, producer of zinc at Risdon, as well as byproduct acid, lead, silver, cadmium, and copper, reported a net profit, after all tax and depreciation charges, of £5,678. In the previous fiscal year, the profit was £283,015. Operating profit in 1930-31 was £221,724. The company paid no dividends and added its entire profit to the balance to carry forward for next year. The balance sheet at the end of the year showed total assets of £5,467,645, including £78,841 in investments. Production was 55,282 long tons of zinc, 5,091 tons of lead, 235 tons of cadmium, 127 tons of copper, 58,928 tons of acid, and 754,776 oz. of silver.

United States Zinc Stocks Show Little Change

Production and consumption of zinc in the United States during November held at about the same rate as in the preceding month, according to the American Zinc Institute. Stocks again registered a slight gain, the increase amounting to 199 tons, bringing the total quantity on hand at the end of the month to 130,865 tons. The daily rate of production for November was 684 tons, the lowest since the beginning of the business depression. The daily rate of production for November last year was 1,070 tons.

Unfilled orders increased for the second consecutive month, the low prices evidently attracting more business.

Zinc statistics for October and November, in tons, follow:

	Oct.	Nov.
Production	21,674	20,526
Daily rate	699	684
Shipments	21,163	20,327
Stocks end of month	130,666	130,865
Unfilled orders	18,365	21,355
Retorts operating end of month	23,774	21,828
Retorts, average for month	22,209	20,645

Note: There were no export shipments during October and November.

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Lead Stocks in United States

Total stocks of lead at the works of smelters and refiners in the United States, so far as reported to the American Bureau of Metal Statistics, increased 8,454 tons during October, owing chiefly to the gain in stocks of refined metal. Statistics for Oct. 1 and Nov. 1, in tons, follow:

	Oct. 1	Nov. 1
Ore, matte, and in process at smelters	47,749	48,659
In base bullion:		
At smelters and refiners	9,455	8,921
In transit	1,733	2,885
In process	10,822	10,756
Refined lead	128,515	135,800
Antimonial lead	4,289	3,996
Totals	202,563	211,017

The stocks other than refined lead are exclusive of the operations of two companies that smelt for their own use only.

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ALASKA JUNEAU, leading Alaskan gold producer, was handicapped by severe winter weather in November, production dropping to $251,000 and profit to $62,300 before depreciation, depletion, or federal taxes. For the eleven months ended November, Alaska Juneau reports production of $3,478,500 and profit of $1,444,350, compared with $3,076,500 and $978,850 in the corresponding period of 1930.

Mining Company Dividends for November, 1931

Companies in the United States	Situation	Per Share	Total Disbursements
Alaska Juneau, g	Alaska	$0.10 Q	$144,600
American Smelting & Refining	Various	0.37½	686,228
Homestake Mining, g	S. Dakota	0.65 M	163,254
Mohawk Mining, c	Michigan	0.25 Q	28,750
National Lead, pfd., "B"	Various	1.50 Q	154,913
New Jersey Zinc	Various	0.50 Q	981,632
United Gold Mines	Colorado	0.01	48,017
United Verde Extension, c	Arizona	0.25 Q	262,500
Companies in Other Countries			
Cerro de Pasco, c, s	Peru	0.25 Q	282,710
Granby Consolidated, c	Canada	0.25 Q	112,500
Hollinger Consolidated Gold	Canada	0.05 M	246,000
International Nickel, pfd., c, n	Canada	1.75 Q	158,959
Teck-Hughes, g	Canada	0.20 QX	1,084,764
Total			$4,354,827

c, copper; s, zinc; l, lead; s, silver; g, gold; n, nickel; Q, quarterly; M, monthly; X, extra.

Kennecott Group Dividends Cut; Noranda Resumes Payment

Kennecott, Utah, and Nevada Consolidated, all companies of the Kennecott group, have cut their dividends for the fourth quarter of 1931, but one copper company has actually resumed payments. Noranda Mines, which, after a year in which no distribution was made to stockholders, will pay 50c. a share on Dec. 29.

The action of the Kennecott companies was not unexpected, as Nevada's last quarterly report showed a loss of nearly $1,500,000. The new rates are 12.5c. a share quarterly for Kennecott, compared with 25c. formerly; 10c. a quarter for Nevada, compared with 20c. formerly; and $1 a quarter for Utah, compared with $1.50 formerly.

Noranda Mines, although it is nominally a copper producer, actually is recovering more from its gold and silver output at present, because of the drop in the price of copper. The company's 50c. declaration on its 2,239,772 shares does not represent a commitment as to future dividend policy, J. Y. Murdoch, president, stated. As earnings are now at the rate of about $1.30 annually, a regular 50c. quarterly distribution is not likely. Noranda, having started operations only in 1927, has not yet entrenched its treasury position to the point where payments out of surplus are justified.

■

Aluminum Group Forms Marketing Organization

The recent formation of Alliance Aluminium Compagnie A.G., Basle, with capital of 35,000,000 Swiss francs, indicates that full accord exists in foreign aluminum circles on the marketing of the metal. The board of directors of the new company includes representatives of Swiss, German, French, British, and Canadian producers.

The company, according to a preliminary announcement, has been organized to develop the aluminum market. Price stabilization is to be achieved through adjusting production to demand. The fact that the Canadian producer has joined the group greatly strengthens the marketing organization.

Alliance Aluminium replaces the international working agreement that was first entered into in 1923. This agreement was limited to price fixing among European producers, but excluded North American producers. In 1926, a more comprehensive agreement was made for two years, which was extended at the end of 1928 for another three years, and would therefore have expired at the end of 1931.

The terms of the old agreement of the cartel included an article to regulate and control the aluminum sales of each of its members, more particularly by exchange of commercial information in their possession. Sales were controlled by a quota allocated to each member.

L. Marlio, Paris, managing director of Compagnie de Produits Chimiques et Electrometallurgiques, is president of the new company; R. W. Cooper, chairman of British Aluminium Company, is vice-president.

■

Soviets Propose Cut in Manganese Output

The Soviet authorities have planned a heavy reduction in the output of manganese ore for the current fiscal year, according to Landreth M. Harrison, third secretary of the United States legation at Riga.

In the fiscal year 1929-30, Soviet Russia produced 1,444,166 metric tons, roughly 44 per cent of the total for the world. The planned output for the calendar year 1930 was 1,583,000 metric tons; it has been set at 960,000 tons for 1931, a reduction of 623,000 tons, or approximately 40 per cent. This planned reduction amounts to 43 per cent of the actual output in the fiscal year 1929-30, the last period for which production statistics are available.

■

North Broken Hill Report

North Broken Hill, lead-zinc-silver producer of New South Wales, Australia, reports a net profit of £84,929 in the year ended June 30, 1931. The previous fiscal year yielded £260,395 in profit. These figures represent net after deductions for taxes, royalty, and depreciation, and after inclusion of credit for interest and dividends. Operating profit in the 1930-31 fiscal year was only £4,319 on a mine production of £484,962. The company paid £26,250 in dividends. After provision for new plant and debenture sinking fund, the balance to carry forward is £478,939, compared with £477,189 brought forward from the previous year. The company's total assets are put at £2,908,759, including £817,016 of shares in other companies at cost.

■

Financial Notes

NORTH LILY MINING, subsidiary of International Smelting, in the Tintic district, Utah, reports net income, after reserve for federal taxes, of $20,299 in the third quarter of 1931. Second-quarter income was $4,163. In the third quarter, 6,205 tons of ore realized $68,001.

WALKER MINING, copper producer of Plumas County, Calif., reports a net loss, after depreciation, of $42,032 in the third quarter of 1931. Second-quarter loss was $10,968. In the third quarter, 6,027 tons of concentrate realized $213,798.

Lead Production of the World

(American Bureau of Metal Statistics)

World production of lead during October was at the rate of 3,806 tons daily, against 3,654 tons in September, and 4,923 tons in October, 1930. Production of base bullion by Mount Isa, Australia, does not appear in the subjoined compilation, which is on the basis of refined lead. Mount Isa produced base bullion, in tons, as follows: June, 877; July, 2,476; August, 2,536; September, 2,560; October, 3,584. All figures are in short tons.

Lead Production, June to October, 1931

	June	July	Aug.	Sept.	Oct.
United States	30,708	32,157	34,144	31,966	36,546
Canada	11,262	10,412	10,209	10,262	10,537
Mexico	21,093	18,421	21,434	16,629	17,886
Germany	10,097	8,557	9,732	9,736	10,567
Italy	1,941	2,385	1,699	2,157	2,679
Spain and Tunis (a)	7,987	6,993	7,574	6,715	6,336
Europe (b)	15,700	15,500	15,800	15,600	13,900
Australia	13,037	12,096	12,520	8,266	10,135
Burma	6,815	6,698	6,698	6,698	6,698
Elsewhere (c)	1,200	1,200	1,200	1,600	2,700
Totals	119,840	114,419	121,010	109,629	117,984
United States	30,708	32,157	34,144	31,966	36,546
Elsewhere	89,132	82,262	86,866	77,663	81,438

(a) Partial. (b) European countries not elsewhere specified. (c) Estimated or partly estimated.

Copper Negotiations Are Resumed—Prices Unsettled in Quiet Market

New York, Dec. 10, 1931.—The feature in the market for non-ferrous metals was the announcement made in Brussels on Nov. 26 that Katanga had notified representatives of Rhokana that the proposals made in New York recently with regard to curtailment of production are acceptable. Negotiations among copper producers were resumed immediately. Buying of copper, lead, zinc, and tin was in moderate volume, with prices generally lower. The *E.&M.J.* weighted index of non-ferrous metal prices for the month of November was 54.91, against 55.08 in October. The November figure establishes a new low.

Copper Makes New Low

Early in the period, with producers downcast over what appeared to be the end of the copper conference, prices developed weakness, actual business passing as low as 6¼c. per pound, Connecticut, basis, a new all-time low. The market drifted aimlessly until two events startled traders, one being the notice of Phelps Dodge to withdraw from Copper Exporters, Inc., within 30 days, which was posted on Nov. 25, and the other the announcement from Brussels that the curtailment proposals would be accepted by Katanga. The specter of tariff action by the United States, and, possibly England, it was thought, had much to do with changing the views of the Belgians.

Copper negotiations were resumed at once and the market became a little more orderly. Some sellers advanced the price to 6¾c., but a moderate tonnage continued to come on the market almost daily at 6½c., delivered Connecticut.

Satisfactory allocation of production curtailment has now been pretty well settled. Two or three of the smaller companies may not fully meet the wishes of the rest, but this will probably be no stumbling block. Foreign marketing problems are also being straightened out, and it seems apparent that Copper Exporters will no longer market some of its supply as "non-participating." Many details remain to be ironed out, but some announcement of a successful outcome can be expected before the end of the year, and perhaps in a few days. Most copper people expect to see Phelps Dodge back in the export association.

The subject of a United States tariff on copper is still very much alive. The report on copper by the Tariff Commission is expected to be ready soon.

On Nov. 20, Copper Exporters reduced the c.i.f. quotation from 7.50c. to 7c. per pound. Export sales for November totaled 24,678 long tons.

Zinc Down to 3.125c.

Demand was slow and prices again eased off, moderate quantities of Prime Western selling down to 3.125c. per pound, St. Louis, the low for the movement. Toward the close the market steadied slightly on prospects that production will continue at about the present rate. The daily rate of production for November was 684 tons, against 699 tons in October. Stocks of zinc in the United States have held around 130,000 tons for several months, indicating that production and consumption just about balance.

Lead Holds Steady

Sales of lead during the period were somewhat below the average in volume, but prices were well maintained. The market closed at 3.85c., New York, the contract basis of the American Smelting & Refining Company, and 3.65c., St. Louis. One producer took most of the business, which made it appear that the market was an extremely dull affair so far as other operators were concerned. In view of the fact that producers sold a good tonnage of lead late in October and early in November for December shipment, no selling pressure in lead has been in evidence. The undertone appears to be fairly steady. Operators in lead are following developments in copper with great interest, as an agreement among producers of the red metal would probably exert a favorable influence on the other major non-ferrous metals.

Lead already sold for December shipment is in excess of 31,000 tons. Most of the business booked recently was for December shipment. The quantity purchased for January shipment, however, is small, indicating that consumers soon will have to come into the market for a good tonnage for that position. Production of lead is said to be proceeding at a lower rate than in November.

Silver Unsettled

The silver market has been erratic, owing largely to the unsettlement in commodity and security markets. Coinage of silver appears to be increasing in some countries, chiefly Germany, and with production still falling, silver operators look for an improved call for the metal and steady prices.

Tin at New Low

Continued weakness in sterling exchange again unsettled the market for tin, and prices eased off, prompt Straits metal selling down to 20½c. per pound, a new low for the movement. Demand was quiet, most consumers evidently being in a comfortable position in respect to supplies. World production of tin during October was 11,016 long tons, according to the American Bureau of Metal Statistics, against 10,097 long tons in September, and 13,115 long tons in August. Production for the first ten months of the current year was estimated at 126,355 long tons, against 142,800 long tons in the same period last year.

Average Metal Prices for November, 1931

COPPER:	
Electrolytic, refinery	6.558
London Standard, Spot	35.854
London Electrolytic, Bid	41.190
LEAD:	
New York	3.937
St. Louis	3.758
London Spot	14.577
London Forward	14.491
SILVER:	
New York	32.223
London	19.393
Sterling Exchange	371.130
ZINC:	
St. Louis	3.209
London Spot	13.845
London Forward	14.247
TIN:	
Straits	22.779
London Standard Spot	132.857
QUICKSILVER	68.587
ANTIMONY	6.679
PLATINUM, Refined	40.000
CADMIUM	55.000
ALUMINUM, 99 Per Cent Plus	23.300

Zinc and Lead Concentrates

The Joplin, Mo., market for zinc concentrate settled at $19 per ton for Prime, base 60 per cent. Lead, basis 80 per cent, settled at $37.50@$40 per ton.

Other Metals

Quotations cover wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., delivered, Alcoa commercial and mill ingot, 99 and 98 per cent, 28.30c.; Alcoa No. 12 alloy, 22c.; metallurgical ingot, 94 per cent plus, 23.30c.; 98@99 per cent, 22.90c.

ANTIMONY—Per lb., duty paid. Chinese, spot, 6.25c.; futures, 6c.

BISMUTH—Per lb., in ton lots, $1.15.

CADMIUM—Per lb., 55c.

IRIDIUM—Per oz., $100@$105 for 98@99 per cent sponge and powder.

NICKEL—Per lb., electrolytic cathodes, 35c.; shot and ingot made from remelted electro, 36c. for single lots of spot metal.

PALLADIUM—Per oz., $19@$21.

PLATINUM—Per oz., official price of leading interest, $40. Cash transactions between dealers and refiners several dollars less. London, £10 2s. 6d., nominal.

QUICKSILVER—Per 76-lb. flask, $67@$68. Business confined chiefly to small lots. On 100 flasks or more $67 could have been shaded.

Daily Prices of Metals

Nov. Dec.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	w York	New York	St. Louis	St. Louis
19	6.275	22.75	3.95	3.80	3.225
20	6.275	22.875@23.10	3.95	3.75	3.20
21	6.025@6.275	23.00	3.95	3.75	3.20
23	6.025@6.275	22.80	3.85	3.65	3.175
24	6.025@6.275	22.75@23.00	3.85	3.65	3.15
25	6.025@6.275	22.75@23.10	3.85	3.65	3.125
Av'ge	6.192	22.890	3.900	3.708	3.179
26	Holiday	Holiday	Holiday	Holiday	Holiday
27	6.275	22.25	3.85	3.65	3.125
28	6.525	22.25	3.85	3.65	3.125
30	6.275	21.40	3.85	3.65	3.125
1	6.275	20.875	3.85	3.65	3.125@3.15
2	6.275	21.25	3.85	3.65	3.125
Av'ge	6.325	21.605	3.850	3.650	3.128
3	6.275	21.00	3.85	3.65	3.125@3.15
4	6.275	20.75@21.00	3.85	3.65	3.15
5	6.275	20.75	3.85	3.65	3.15
7	6.275	20.50@20.625	3.85	3.65	3.15
8	6.275	20.60	3.85	3.65	3.175
9	6.275	20.50@20.70	3.85	3.65	3.15@3.175
Av'ge	6.275	20.731	3.850	3.650	3.154

Average prices for calendar week ended November 21, 1931 are Copper, 6.463c.; Straits Tin, 22.915c.; New York Lead, 4.000c.; St. Louis Lead, 3.833c.; Zinc, 3.246c.; Silver, 30.875c.

Average prices for calendar week ended November 28, 1931 are Copper, 6.250c.; Straits Tin, 22.620c.; New York Lead, 3.850c.; St. Louis Lead, 3.650c.; Zinc 3.140c.; Silver, 29.725c.

Average prices for calendar week ended December 5, 1931 are Copper, 6.275c.; Straits Tin, 21.025c.; New York Lead, 3.850c.; St. Louis Lead, 3.650c.; Zinc, 3.138c.; Silver, 28.688c.

Silver, Gold and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov. Dec.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
19	3.75¼	30⅜	18 1/16	109s 1d	30	3.39½	28⅝	18 13/16	117s 11d
20	3.73	30¾	18 5/16	109s 7d	1	3.30½	28½	19¼	125s ..
21	3.72	30⅝	18½	.....	2	3.40	28¾	19 7/16	126s 7d
23	3.65	29¾	18 5/16	111s 9d	3	3.36¾	28¾	19⅛	122s 3d
24	3.65½	30⅛	18 1/16	113s 5d	4	3.33½	28¾	19 7/16	122s ..
25	3.64½	29¾	18 7/16	111s 10d	5	3.29¼	29	19⅝	.....
26	Holiday	Holiday	18 9/16	114s 2d	7	3.25½	30	20½	126s 2d
27	3.53	29⅝	19⅛	115s ..	8	3.24½	29⅝	20 1/16	126s 10d
28	3.51½	29⅜	19⅛	.....	9	3.27	29⅛	19¾	126s 6d

Average for week ended November 25, 1931: Silver, 30.229c.; Sterling Exchange, $3.69208.

Average for week ended December 2, 1931: Silver, 28.925c.; Sterling Exchange, $3.42900.

Average for week ended December 9, 1931: Silver, 29.208c.; Sterling Exchange, $3.29417.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis of 925 fine. Sterling quotations represent the demand market in the forenoon. Cables commanded one-half cent premium on Dec. 8, 1931.

London

Nov. Dec.	Copper Standard		Electrolytic	Tin		Lead		Zinc	
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
19	33 3/16	33 13/16	39½	131⅛	133¼	14 7/16	14 5/16	13¾	14¼
20	33⅜	34¼	39	133¼	135⅜	14 9/16	14½	13 7/16	14¼
23	33 13/16	34 5/16	39	135¾	138	14 15/16	14¾	14 3/16	14 9/16
24	33⅝	34⅛	39	135¼	138¼	14 15/16	14 11/16	14⅛	14 7/16
25	33¾	34 5/16	39	137⅛	139⅝	14⅜	14½	14	14 5/16
26	32¼	32⅝	38	135¼	137¾	14 9/16	14⅜	13 11/16	14
27	34½	35	41	137	139⅝	14¾	14½	13 7/8	14¼
30	36⅛	36¾	41	136¼	139	15	14¾	14	14⅜
1	37 7/8	38½	43	138⅜	141	15 7/16	15 9/16	14½	15
2	37⅜	38	43	137¼	140	15 1/16	15¼	14⅜	14 7/8
3	36⅝	37¼	42	136½	139⅜	15 1/16	15 3/16	14 7/16	14⅞
4	36 11/16	37 5/16	42	136¾	139¼	15 1/16	15 3/16	14⅜	14 13/16
7	38	38⅝	43	138⅛	141	15 5/16	15 7/16	14½	14 15/16
8	38½	39½	43	138½	141⅛	15½	15⅝	14½	14 15/16
9	38	38⅝	43	137¼	140⅛	15⅛	15 5/16	14 3/16	14⅛

Prices for lead and zinc are the official prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

Chromium, Cobalt, Indium, Lithium, Magnesium, Manganese, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Silicon, Tantalum, Tellurium, Thallium, Titanium, and Tungsten are unchanged from prices given in the Nov. 23 issue.

Metallic Ores

Prices in tons of 2,000 lb., or in "Units" of 20 lb., unless otherwise stated.

BERYLLIUM ORE—Per ton, minimum 10 per cent BeO, $20@$30, f.o.b. mines. Supplies more than adequate. In small lots for export, $20@$60 per ton, depending upon quality and quantity of the material offered.

CHROME ORE—Per long ton, c.i.f. Atlantic ports, Indian ores, $17.50 for 46@48 per cent Cr_2O_3 ore, and $19.50@$20 for 50@51 per cent ore.

TUNGSTEN ORE—Per unit of WO_3, New York; Chinese wolframite, duty paid, $11@$11.25. Bolivian scheelite, $10.90@$11; domestic scheelite, $10.50@$12. Nominal.

Antimony, Cobalt, Iron, Manganese, Molybdenum, Tantalum, Tin, Titanium, Vanadium, and Zircon ores are unchanged from prices in the No. 23 issue.

Non-Metallic Minerals

Non-metallic mineral quotations are unchanged from those given in the issue of Nov. 23.

Metallic Compounds

COPPER SULPHATE—Per lb. in carloads, 3.10c., f.o.b. New York.

Prices on Arsenious Oxide, Calcium Molybdate, Cobalt Oxide, Sodium Nitrate, Sodium Sulphate, Zinc Oxide, and Zirconium Dioxide are unchanged from those in the Nov. 23 issue.

Refractories

Refractories unchanged from prices quoted in Nov. 23 issue.

Alloys

BERYLLIUM—Per lb. of contained Be, $50, chiefly sold as an alloy of 12 per cent Be and 88 per cent Cu.

Prices on other alloys unchanged from those given in the Nov. 23 issue.

Rolled Metals

Rolled metals unchanged from prices quoted in Nov. 23 issue.

Sterling Exchange, 90-Day

Sterling exchange, 90-day demand: Nov. 19th, $3.74¼; 20th, $3.72; 21st, $3.71; 23d, $3.64; 24th, $3.64; 25th, $3.63; 26th, Holiday; 27th, $3.52; 28th, $3.50; 30th, $3.38; Dec. 1st, $3.29, 2d, $3.38; 3d, $3.36; 4th, $3.32½; 5th, $3.28; 7th, $3.24½; 8th $3.24; 9th, $3.25½.

Metal Statistics

Monthly Average Prices of Metals

(See daily price table for basis of quoting)

Silver

	New York		London Spot		Sterling Exchange	
	1930	1931	1930	1931	1930	1931
January	45.000	29.423	20.896	13.810	486.447	485.260
February	43.193	26.773	20.008	12.432	485.784	485.551
March	41.654	29.192	19.298	13.524	485.933	485.596
April	42.428	28.279	19.554	13.120	486.019	485.764
May	40.736	27.650	18.850	12.858	485.724	486.188
June	34.595	27.250	16.049	12.707	485.625	486.291
July	34.346	28.255	15.928	13.197	486.300	485.349
August	35.192	27.524	16.283	12.815	486.839	485.284
September	36.315	28.180	16.738	14.101	485.888	451.245
October	35.846	29.538	16.563	17.153	485.719	388.029
November	35.908	32.223	16.625	19.393	485.454	371.130
December	32.635	.....	15.201	.....	485.413	.....
Year	38.154	.....	17.666	.....	485.929	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine. Sterling exchange in cents.

Copper

	F.O.B. Refinery Electrolytic		London Spot Standard		London Spot Electrolytic	
	1930	1931	1930	1931	1930	1931
January	17.775	9.838	71.469	44.938	83.250	47.524
February	17.775	9.724	71.419	45.372	83.500	47.950
March	17.775	9.854	69.202	44.818	83.405	47.699
April	15.621	9.392	62.075	42.694	74.338	45.375
May	12.756	8.665	53.159	38.897	59.545	42.175
June	12.049	8.025	50.003	35.827	56.750	38.966
July	11.023	7.698	48.277	34.462	52.522	37.293
August	10.693	7.292	47.525	32.572	50.725	35.388
September	10.310	6.988	46.264	31.503	49.500	36.148
October	9.597	6.775	43.030	34.957	45.772	41.000
November	10.113	6.558	46.134	35.854	48.963	41.190
December	10.300	.....	46.771	.....	50.065	.....
Year	12.982	.....	54.611	.....	61.528	.....

New York quotations, cents per pound. London, pounds sterling per long ton

Lead

	New York		St. Louis		London			
	1930	1931	1930	1931	1930 Spot	1930 3 Mos.	1931 Spot	1931 3 Mos.
January	6.250	4.802	6.100	4.604	21.545	21.571	13.872	13.905
February	6.236	4.552	6.086	4.340	21.188	21.097	13.444	13.550
March	5.662	4.527	5.542	4.276	18.807	18.940	13.128	13.355
April	5.537	4.412	5.428	4.164	18.319	18.363	12.375	12.606
May	5.523	3.818	5.408	3.651	17.795	17.861	11.491	11.778
June	5.410	3.917	5.310	3.761	17.941	17.994	11.582	11.952
July	5.250	4.400	5.149	4.225	18.160	18.063	12.731	12.899
August	5.488	4.400	5.340	4.225	18.294	18.178	11.944	11.994
September	5.500	4.400	5.348	4.217	17.909	17.798	11.932	12.026
October	5.151	3.964	4.999	3.773	15.747	15.674	13.227	13.270
November	5.100	3.937	4.950	3.758	15.954	15.931	14.577	14.491
December	5.100	.....	4.950	.....	15.283	15.292	.....	.....
Year	5.517	.....	5.384	.....	18.077	18.064	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin and Cadmium

	New York		London		Cadmium
	1930	1931	1930	1931	1931
	Straits		Spot		
January	38.851	26.137	175.466	115.798	67.115
February	38.675	26.315	173.750	117.919	55.000
March	36.798	27.065	164.851	121.852	55.000
April	36.077	25.222	162.638	112.775	55.000
May	32.108	23.221	144.818	104.331	55.000
June	30.336	23.478	136.300	104.966	55.000
July	29.822	24.978	134.511	111.478	55.000
August	30.044	25.738	134.988	114.875	55.000
September	29.647	24.618	132.631	117.813	55.000
October	26.802	22.723	117.451	126.932	55.000
November	25.904	22.779	113.519	132.857	55.000
December	25.262	.....	111.560	.....	.....
Year	31.694	.....	141.873	.....	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1930	1931	1930 Spot	1930 3 Mos.	1931 Spot	1931 3 Mos.
January	5.229	4.035	19.634	20.241	12.747	13.113
February	5.180	4.012	19.209	19.778	12.303	12.694
March	4.934	4.002	18.304	18.810	12.190	12.676
April	4.843	3.717	17.819	18.378	11.353	11.838
May	4.641	3.306	16.639	17.330	10.484	10.875
June	4.441	3.416	16.422	17.038	11.270	11.750
July	4.350	3.893	16.171	16.777	12.280	12.802
August	4.360	3.817	15.953	16.469	11.444	12.028
September	4.270	3.744	15.773	16.080	11.571	12.063
October	4.050	3.377	14.446	14.935	12.733	13.216
November	4.266	3.209	14.706	15.238	13.845	14.247
December	4.099	.....	13.762	14.214	.....	.....
Year	4.556	.....	16.570	17.107	.....	.....

St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver, and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1930	1931	1930	1931	1930	1931
January	8.606	7.317	121.192	103.000	61.923	36.000
February	8.830	7.069	120.500	100.205	59.909	34.000
March	8.236	7.127	118.808	100.423	54.769	29.538
April	7.740	6.888	114.000	102.077	46.462	26.346
May	7.454	6.524	117.269	101.140	46.000	24.980
June	7.057	6.342	118.600	92.058	46.000	37.115
July	6.976	6.802	117.462	85.808	43.692	40.000
August	7.839	6.596	116.000	80.115	41.462	40.000
September	7.773	6.542	113.620	76.300	36.080	40.000
October	7.288	6.517	110.596	72.385	36.000	40.000
November	7.105	6.679	106.717	68.587	36.000	40.000
December	7.099	.....	105.346	.....	36.000	.....
Year	7.667	.....	115.009	.....	45.358	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce.

Pig Iron[1] and Aluminum

	Bessemer		Basic		No. 2 Foundry		Aluminum	
	1930	1931	1930	1931	1930	1931	1930	1931
January	19.00	17.50	18.50	17.00	18.50	17.00	24.300	23.300
February	19.00	17.29	18.50	16.79	18.50	16.79	24.300	23.300
March	19.00	17.00	18.50	16.50	18.50	16.50	24.300	23.300
April	19.00	17.00	18.50	16.50	18.50	16.50	24.300	23.300
May	19.00	17.00	18.50	16.38	18.50	16.44	24.300	23.300
June	19.00	17.00	18.50	15.50	18.50	16.00	24.140	23.300
July	18.62	17.00	18.12	15.50	18.12	16.00	23.300	23.300
August	18.50	17.00	18.00	15.50	18.00	16.00	23.300	23.300
September	18.38	17.00	17.76	15.50	17.88	16.00	23.300	23.300
October	17.85	16.92	17.00	15.42	17.22	16.00	23.300	23.300
November	17.50	16.50	17.00	15.00	17.00	16.00	23.300	23.300
December	17.50	.....	17.00	.....	17.00	.....	23.300	.....
Year	18.53	.....	17.99	.....	18.02	.....	23.787	.....

Iron in dollars per long ton. Aluminum in cents per pound, 99 per cent grade
[1]F.o.b. Mahoning and Shenango Valley furnaces; freight to Pittsburgh, $1.76

Monthly Crude Copper Output in Short Tons

	1930	1931				
		June	July	Aug.	Sept.	Oct.
Domestic						
Alaska shipments	18,953	1,303	1,048	748	2,090	338
Magma	15,940	1,437	1,229	.....	.....	.....
Miami	34,568	2,174	2,032	.....	.....	.....
Nevada Consolidated	70,990	(d) 16,504	.....	.....	(d) 16,194	.....
Old Dominion (a)	10,428	600	575	539	.....	.....
Phelps Dodge (b)	72,308	5,178	5,179	5,166	.....	.....
United Verde Extension	21,908	1,642	...	.....	.....	.....
Tennessee Corporation	7,772	833	742	.....	.....	.....
Foreign						
Andes Copper	47,428	3,498	.....	.....	.....	.....
Braden	79,923	8,593	8,595	.....	.....	.....
Boleo, Mexico	13,940	(d) 3,107	.....	.....	(d) 3,283	.....
Chile	89,100	7,122	....	.....	.....	.....
Furukawa, Japan	18,536	1,505	1,431	1,427	1,561	.....
Howe Sound	22,633	(d) 4,001	.....	.....	.....	.....
Messina	(c) 7,600	870	832	897	.....	.....
Mt. Lyell	10,878	.....	.....	.....	.....	.....
Sumitomo, Japan	15,429	1,286	1,255	1,260	955	.....

(a) Includes Arizona Commercial. (b) Moctezuma is included. (c) Fiscal year. (d) Three months.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1929		1930		1931	
	Monthly Production	Daily Rate	Monthly Production	Daily Rate	Monthly Production	Daily Rate
January	86,324	2,785	67,838	2,188	48,059	1,550
February	84,735	3,026	59,196	2,144	47,504	1,697
March	93,698	3,023	61,216	1,975	48,702	1,571
April	94,902	3,163	60,450	2,015	46,452	1,548
May	93,392	3,013	60,238	1,943	45,580	1,470
June	82,354	2,745	56,743	1,891	44,473	1,482
July	79,229	2,556	54,249	1,750	38,228	1,233
August	78,885	2,545	56,779	1,832	38,925	1,256
September	79,402	2,647	56,584	1,886	38,088	1,270
October	82,575	2,664	55,954	1,805	.....	....
November	75,934	2,531	53,141	1,771	.....	....
December	74,772	2,412	48,518	1,565	.....	....
Total	1,006,203	....	690,263	....	396,011	....
Monthly average	83,850	....	57,522	....	44,001	....
Av. of daily rate	.....	2,757	.....	1,891	.....	1,451

Mining Share Prices—Month of November, 1931

Company Name	High	Low	Last	§Most Recent Dividend
NEW YORK STOCK EXCHANGE				
Alaska Juneau	17½	13⅜	13⅜	Oc. 10, No. 2, 1931....Q 0.10
American Metal	10⅝	6.00	6.25	December, 1930.....Q 0.25
Am. Metal, pfd	41	28⅜	29	Au. 22, Se. 1, 1931.....Q 1.50
Am. Sm. & Ref	36½	22½	23	Oc. 16, No. 10, 1931...Q 0.37½
Am. Sm. & Ref. 2d pfd	75½	71	71	No. 6, De. 1, 1931.....Q 1.50
Am.Sm. & Ref. 1st pfd.	101½	99½	100	No. 6, De. 1, 1931.....Q 1.75
Am. Zinc, L. & S.	5.00	3.25	3.50	May, 1917..... 1.00
Am. Zinc, L. & S., pfd.	40	32	39½	October, 1930.....Q 1.50½
Anaconda	19⅜	13½	13⅜	Jy. 11, Au. 17, 1931.....Q 0.37½
Andes Copper	9.00	6.12½	6.12½	Ja. 10, Fe. 9, 1931.....Q 0.25
Butte C. & Z.	2.62½	1.50	1.62½	December, 1929..... 0.50
Butte & Superior	1.00	0.87½	0.87½	December, 1929.....Q 0.50
Callahan Zinc-Lead	0.62½	0.37½	0.37½	December, 1920..... 0.50
Cal. & Hecla	5.50	4.00	4.25	June, 1930..... 0.50
Cerro de Pasco Copper	23½	13½	14⅜	Jy. 16, Au. 1, 1931.....Q 0.25
Dome Mines	9.50	8.12½	8.12½	Je. 30, Jy. 20, 1931.....Q 0.25
Federal M. & S.	45	40	45	June, 1927.....10.00
Federal M. & S., pfd	56	50	50	My. 25, Je. 5, 1931....Q 1.75
Freeport Texas	23½	16½	16⅜	No. 15, De. 1, 1931....Q 0.75
Granby Con	12	6.25	7.87½	Oc. 16, No. 2, 1931....Q 0.25
Greene Cananea	....	....	73½*	July, 1930..... 0.75
Homestake	132½	111	117	No. 20, No. 26, 1931..M 0.65
Howe Sound	22½	14½	15	Se. 30, Oc. 15, 1931...Q 0.50
Inspiration	6.25	4.00	4.00	July, 1930..... 0.50
International Nickel	13½	8.50	8.75	Au. 31, Se. 30, 1931...Q 0.10
Int. Nickel, pfd.	97	87	88½	Oc. 3, No. 2, 1931.....Q 1.75
Kennecott Copper	17⅛	11⅞	12½	Se. 18, Oc. 1, 1931.....Q 0.25
McIntyre Porcupine	20½	15½	15⅝	No. 2, De. 1, 1931.....Q 0.25
Magma Copper	12⅛	7.50	8.25	Se. 30, Oc. 15, 1931....Q 0.25
Miami Copper	5.00	3.75	4.00	August, 1930..... 0.375
Mother Lode	0.50	0.37½	0.37½	June, 1930..... 0.10
National Lead	101	92	92	De. 11, De. 31, 1931..QX 1.50
National Lead, pfd. A	134⅛	130	130	No. 27, De. 15, 1931...Q 1.75
National Lead, pfd. B	104	104	104	Oc. 16, No. 2, 1931.....Q 1.50
Nevada Con	8.50	5.75	5.75	Se. 18, Se. 20, 1931....Q 0.20
Noranda Mines	17⅛	12⅛	12⅞	De. 15, De. 29, 1931.... 0.50
Park Utah Con	2.25	1.37½	1.37½	July, 1929.....Q 0.20
Patiño M. & E.	8.87½	7.00	7.87½	December, 1929..... 4s.
Phelps Dodge	11½	7.25	7.50	Je. 18, Jy. 1, 1931.....Q 0.25
Rand Mines	25	16	16	August, 1930..... 1.52
St. Joseph Lead	16½	11⅜	11⅞	De. 10, De. 21, 1931...Q 0.25
Seneca Copper	0.50	0.37½	0.50	....
Tennessee Corp	3.87½	3.12½	3.12½	Fe. 28, Mh. 16, 1931...Q 0.125
Texas Gulf Sulphur	30⅛	25½	25⅜	De. 1, De. 15, 1931....Q 0.75
U. S. S. R. & M.	25½	16⅛	16⅛	Jy. 2, Jy. 15, 1931.....Q 0.25
U. S. S. R. & M., pfd.	42	38	40	Jy. 2, Jy. 15, 1931.....Q 0.87½
Utah Copper	....	....	50*	Se. 18, Se. 30, 1931....Q 1.50
Vanadium Corp	23¾	15½	15⅜	Fe. 2, Fe. 16, 1931.....Q 0.75
NEW YORK CURB EXCHANGE				
Aluminum Co. of Am.	92½	66	71½	....
Alum. Co. of Am., pfd.	82	75	75	Mr. 14, Ap. 1, 1931....Q 1.50
Anglo-Chilean Con	0.75	0.50	0.62½	4 shares Cosach B...June, 1931
Bunker H. & S.	39	24½	27½	My. 29, Je. 5, 1931.....0.25
Carnegie Metals	2.00	0.75	1.00	....
Comstock Tunnel	0.56½	0.25	0.50	....
Con. Coppermines	1.62½	1.12½	1.12½	....
Copper Range	....	....	3.75*	July, 1930..... 0.25
Cresson Consolidated	0.37½	0.31½	0.31½	Je. 30, Jy. 10, 1931.....Q 0.01
Cusi Mexicana	0.87½	0.37½	0.43¾	....
Evans-Wallower	0.81½	0.50	0.50	....
Federated Metals	7.62½	7.50	7.50	Ja. 5, Ja. 15, 1931.....Q 0.25
Hecla Mining	7.00	4.50	5.25	No. 15, De. 15, 1931...Q 0.10
Hollinger Consolidated	5.75	5.00	5.00	No. 18, De. 2, 1931.MX 0.10
Hudson Bay M. & S.	4.00	2.37½	2.50	....
Iron Cap Copper	0.56½	0.56½	0.56½	....
Mayflower Associates	30½	30	30	De. 1, De. 15, 1931....Q 0.50
Mining Corporation	1.50	1.50	1.50	December, 1929..... 0.12½
New Jersey Zinc	31⅜	28⅛	28⅜	Oc. 20, No. 10, 1931....Q 0.50
Newmont Mining	21⅛	15	16½	Mh. 31, Ap. 15, 1931...Q 1.00
N. Y. & Honduras Ros.	15	12½	15	Jy. 21, Jy. 31, 1931.....Q 0.25
Nipissing	1.62½	1.00	1.00	Mh. 31, Ap. 20, 1931...Q 0.075
Ohio Copper	0.18⅜	0.12½	0.18⅛	September, 1926..... 0.03
Premier Gold	0.81½	0.50	0.50	Je. 11, Jy. 3, 1931.....Q 0.03
Quincy	3.00	2.75	3.00	March, 1920..... 1.00
Shattuck Denn	3.87½	2.25	2.25	....
So. Am. Gold & Plat	0.87½	0.87½	0.87½	....
Teck-Hughes	5.62½	4.37½	4.37½	Oc. 18, No. 2, 1931....QX 0.20
Tonopah Mining	....	....	0.50*	October, 1929..... 0.07½
United Eastern	....	....	0.06¼*	....
United Verde Ex	5.50	3.62½	4.00	Oc. 2, No. 2, 1931.....Q 0.25
Utah-Apex	0.75	0.50	0.50	December, 1929..... 0.02
Yukon Gold	0.12½	0.12½	0.12½	June, 1918..... 0.02
BOSTON STOCK EXCHANGE				
Isle Royale	2.50	2.25	2.50	March, 1930..... 0.50
Mohawk Mining	17	12¾	13½	Oc. 31, No. 28, 1931...Q 0.25
Old Dominion	1.25	1.25	1.25	December, 1918..... 1.00
Utah Met. & Tunnel	0.38	0.31	0.33	December, 1927..... 0.30
¶MONTREAL				
Asbestos Corp	0.50	0.25	0.50	January, 1926..... 1.50
Asbestos Corp., pfd	1.00	1.00	1.00	January, 1930..... 1.75
Consolidated M. & S.	0.90	0.65	0.70	Je. 23, Jy. 15, 1931....SA 1.25

Company Name	High	Low	Last	§Most Recent Dividend
SPOKANE				
Constitution	....	....	0.06¾*	....
Dayrock	....	....	0.95*	March, 1930..... 0.03
Golconda	0.28½	0.18	0.23½	July, 1929..... 0.02
Jack Waite Con	0.39	0.26	0.26	....
Los Lugos	....	....	0.01¾*	....
Mexican Premier	0.16	0.11½	0.12	January, 1930..... 0.01
Montana Mines	....	....	0.09*	....
Noble Five	....	....	0.03*	January, 1930..... 0.005
Pend Oreille	1.32	0.81	0.95	....
Sherman Lead	....	....	0.31*	March, 1930..... 0.01
Sidney	....	....	0.05*	October, 1929..... 0.01
Sunshine Mining	2.10	1.12	1.21	December 20, 1930.....Q 0.03
Tamarack & Custer	0.22	0.17	0.17½	September, 1924..... 0.25
SALT LAKE CITY				
Chief Con	0.54	0.41	0.41	February, 1928..... 0.10
Combined Metals	0.06½	0.05½	0.05½	....
Eureka Bullion	0.24½	0.17½	0.17½	....
Eureka Lilly	0.15	0.12	0.12½	....
Moscow Silver	0.40	0.40	0.40	....
New Quincy	0.12	0.04½	0.05½	September, 1929.....Q 0.10
North Lily	1.07½	0.75	0.83	January, 1930..... 0.15
Park Bingham	0.03	0.02½	0.02½	....
Park City Con	0.23	0.14	0.15	....
Rico Argentine	0.04½	0.04	0.04	December, 1929..... 0.03
Silver King Coalition	5.00	4.05	4.05	De. 20, Ja. 2, 1931....Q 0.15
Tintic Lead	1.07½	0.95	0.97	....
Tintic Standard	4.35	3.30	3.55	Se. 18, Se. 30, 1931....Q 0.10
Walker Mining	1.10	0.93	0.95	April, 1930..... 0.075
¶ TORONTO				
Abana Mines	0.10	0.03½	0.03½	....
Amulet Mines	0.29	0.14	0.20	....
Barry-Hollinger	1.35	0.80	1.02	....
Base Metals	0.12½	0.08	0.09	....
Canam Metals	0.02½	0.02	0.02	....
Castle-Trethewey	0.30	0.17	0.17	....
Central Manitoba	0.11	0.07½	0.08	....
Falconbridge	1.60	0.99	1.30	....
Granada Gold	1.90	1.30	1.50	....
Howey Mines	0.39½	0.32	0.33½	....
Keeley	0.35	0.22	0.25	March, 1928..... 0.04
Kirkland Lake	0.60	0.50½	0.51	....
Lake Shore	29½	27¼	29	Se. 1, Se. 15, 1931.....Q 0.50
Sherritt Gordon	0.99	0.51	0.65	....
Siscoe Gold	0.70	0.55	0.56	....
Sylvanite	0.68	0.62	0.62½	De. 5, De. 20, 1930...SA 0.02
Treadwell Yukon	1.60	1.25	1.25	....
Ventures	0.65	0.45	0.48	....
Vipond Con	0.70	0.51	0.53	April, 1927..... 0.03
Waite-A.-M.	1.40	0.90	1.00	....
Wright-Hargreaves	3.21	2.84	2.88	Je. 15, Je. 30, 1931.....Q 0.05
ST. LOUIS, CINCINNATI, AND DENVER				
Consolidated L. & Z	....	....	1.25*	December, 1929..... 0.125
Eagle-Picher	5.25	5.00	5.00	April, 1930..... 0.20
Eagle-Picher, pfd	....	....	0.89*	De. 31, Ja. 15, 1931....Q 1.50
Empire Chief	0.01	0.00⅞	0.01	....
Star of Utah	0.18½	0.18½	0.18½	....
Tungsten Prod	0.09	0.05½	0.05½	....
Ute Gold	0.39	0.24	0.27½	....
SAN FRANCISCO, LOS ANGELES, AND COLORADO SPRINGS				
California Copper	0.25	0.25	0.25	....
(a) Golden Cycle	11⅛	11½	11½	No. 30, De. 10, 1931....Q 0.40
(a) Granite Gold	0.18	0.17	0.18	Je. 22, Jy. 1, 1931.....Q 0.01
Idaho-Maryland	1.48	1.17	1.27	....
Tom Reed	0.60	0.55	0.55	Je. 10, Jy. 1, 1931.....Q 0.03
(a) United Gold	0.05½	0.05	0.05½	Oct. 15, No. 1, 1931.....0.01

‡LONDON

Company Name	High	Low	Last	Most Recent Dividend (Per Cent, Unless Noted)
Anglo American	10/9	9/–	9/6	22½, Feb. 19, 1930
Aramayo Mines	19/3	14/–	17/6	5, Oct. 23, 1929
Burma Corporation	10/10½	8/–	9/1½	1¼, Dec. 10, 1930(b)
Camp Bird	9d	5d	6d	16¼, April 25, 1928
Fresnillo	9/6	8/3	8/9	25 cents, Feb. 12, 1930
Frontino & Bolivia	16/3	13/9	15/–	2½, July 1, 1931
Lake View & Star	9/3	7/3	8/–	11¼, 1921
Mexican Corporation	5/7½	3/–	4/6	10, Oct. 24, 1929
Oroville Dredging	1/9	1/9	1/9	37½, May 16, 1930
Rhokana Corporation	91/3	75/–	80/–	....
Rhodes.-Select. Trust	9/–	7/6	7/6	....
Rio Tinto	367/6	315/–	337/6	10s, May 1, 1931
St. John del Rey	19/–	17/6	17/9	9d, No. 20, 1931
San Francisco Mines	11/3	7/10½	9/6	10, Jan. 7, 1931
Santa Gertrudis	10/7½	7/–	8/3	9d., July 9, 1931
Selukwe	2/7½	1/6	2/3	6¼, April 2, 1917
So. American Copper	1/1½	8d	9d	....
Tanganyika	20/6	16/7½	17/6	2½, Aug. 2, 1930
Wiluna Gold	10/6	7/9	8/–	....
Union Minière	3,750	3,250	3,300†	240 francs, July, 1931

Salt Lake Stock Exchange courtesy J. A. Hogle & Company. ¶These figures are quoted in Canadian dollars. *Not traded in. †Belgian Francs. ‡The above London quotations are for the month ended Nov. 24. Q, quarterly; I, initial; M, monthly; X, extra; SA, semi-annual; L, liquidating B, plus bonus. §Total dividends paid during the month will be found tabulated in the Market and Financial News Section. Dates here given are those of closing of books and payment of dividend. (a) Bid prices. (b) 1¼% (2 annas) dividend, and bonus of ¼% (1 anna). (c) Closing bid prices.